

Dr. N.G.P. ARTS AND SCIENCE COLLEGE

(An Autonomous Institution, Affiliated to Bharathiar University, Coimbatore)
Approved by Government of Tamil Nadu & Accredited by NAAC with A++ Grade (3rd Cycle - 3.64 CGPA)
Dr. N.G.P. -Kalapatti Road, Coimbatore – 641048, Tamil Nadu, India
Web: www.drngpasc.ac.in | Email: info@drngpasc.ac.in | Phone: +91-422-2369100

Regulations 2024-25 for Post graduate Programme

(Outcome Based Education model with Choice Based Credit System)

M.Sc Microbiology Degree

(For the students admitted during the academic year 2024-25 and onwards)

Programme : Microbiology

ELIGIBILITY:

A pass in any one of the following Degree Course of B.Sc. Microbiology / Biotechnology / Biology / Botany / Zoology / Plant Science/ Animal Sciences / Biochemistry / Bioinformatics / Environmental Science / Food and Nutrition/ Clinical Lab Technology of any University in Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, Course to such conditions as may be prescribed thereto are permitted to appear and qualify for the **M.Sc., Microbiology Examination** of this College after a course study of two academic years.

PROGRAMME OBJECTIVES:

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation to:

1. Present intense knowledge in areas of organization and functioning of microorganisms.
2. Familiarize with the operations of bio instruments and related techniques.
3. Enable students to understand the applications of microbiology in healthcare, agriculture, food technology and environmental protection.
4. Provide opportunities to develop skills and participate in Research Projects.



Programme Outcomes

On the successful completion of the programme, the following are the expected outcomes.

PO Number	PO Statement
PO1	To impart knowledge of various branches of Microbiology and to understand the role of microorganisms in human welfare and sustainable development.
PO2	To acquire skills in the techniques used to observe and study the nature of microorganisms and the techniques, skills, and modern tools necessary for biological practice.
PO3	To appreciate the complexities of microbiological processes for industrial and other purposes, especially the genetic manipulation of microorganisms for the production of antibiotics, hormones, etc.
PO4	To inculcate broad education necessary to understand the impact of microbiological solutions in a global and societal context; an ability to function in multi-disciplinary teams; To develop the ability to identify, formulate, and solve biological problems and to design and conduct experiments, as well as to analyze and interpret data.
PO5	To create awareness of contemporary issue and to appreciate the applications of Microbiology to become an entrepreneur.



CURRICULUM

M.SC. MICROBIOLOGY

A.Y – 2024-25

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits	
						Week	Total		CIA	ESE	Total		
First Semester													
24MBP1CA	Core - I	Fundamentals of Microbiology	4	-	-	4	48	3	25	75	100	4	
24MBP1CB	Core - II	Microbial Physiology and Bacterial Diversity	4	-	-	4	48	3	25	75	100	4	
24MBP1CC	Core - III	Mycology, Phycology and Lichenology	4	-	-	4	48	3	25	75	100	4	
24MBP1CD	Core - IV	Comprehensive Biology	3	1	-	4	48	3	25	75	100	3	
24MBP1CE	Core - V	Bio Analytical Techniques	3	1	-	4	48	3	25	75	100	3	
24MBP1CP	Core Practical - I	Basic Techniques in Microbiology	-	-	6	6	72	9	40	60	100	3	
24MBP1DA	DSE - I	Microbial Technology	3	1	-	4	48	3	25	75	100	3	
24BCP1DA		Cancer Biology, Diagnosis and Therapy											
24BTP1DA		Applied Biotechnology											
Total			21	3	6	30	360				700	24	




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M.Sc. Microbiology (Students admitted during the AY 2024-25)

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Second Semester												
24MBP2CA	Core - VI	Microbial Genetics	4	-	-	4	48	3	25	75	100	4
24MBP2CB	Core - VII	Immunology and Immunotechniques	4	-	-	4	48	3	25	75	100	4
24MBP2CC	Core - VIII	Virology	4	-	-	4	48	3	25	75	100	4
24MBP2CD	Core - IX	Medical Bacteriology	3	1	-	4	48	3	25	75	100	3
24MBP2CE	Core - X	Recombinant DNA Technology	3	1	-	4	48	3	25	75	100	3
24MBP2CP	Core Practical -II	Immunology and Molecular Techniques	-	-	6	6	72	9	40	60	100	3
24MBP2DA	DSE - II	Bionanotechnology	3	1	-	4	48	3	25	75	100	3
24BCP2DA		Biochemistry of Toxicology										
24BTP2DA		Forensic Biotechnology										
Total			21	3	6	30	360	-	-		700	24


BoS Chairman/HOD
Department of Microbiology
Dr. N. G. P. Arts and Science College
Coimbatore - 641 048

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BoS- 18th 08/11/2024	AC- 18th 26/11/2024	GB -



Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Third Semester												
24MBP3CA	Core - XI	Environmental and Agricultural Microbiology	4	-	-	4	48	3	25	75	100	4
24MBP3CB	Core - XII	Medical Mycology and Parasitology	4	-	-	4	48	3	25	75	100	4
24MBP3CC	Core - XIII	Pharmaceutical Microbiology and Quality Assurance	4	-	-	4	48	3	25	75	100	4
24MBP3CD	Core - XIV	Food Microbiology and Food Quality Control	4	-	-	4	48	3	25	75	100	4
24MBP3CE	Core - XV	Research Methodology and Biostatistics	3	1	-	4	48	3	25	75	100	3
24MBP3CP	Core Practical - III	Applied Microbiological Techniques	-	-	6	6	72	9	40	60	100	3
24MBP3CT	IT	Internship	-	-	-	-	-	-	40	60	100	2
24MBP3DA	DSE - III	Medical Laboratory Techniques	3	1	-	4	48	3	25	75	100	3
24BCP3DA		Free Radicals and Antioxidant System										
24BTP3DA		Molecular Therapeutics										
Total			22	2	6	30	360	-	-	-	800	27

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Fourth Semester												
24MBP4CA	Core - XVI	Fermentation Technology	4	1	-	5	60	3	25	75	100	3
24MBP4CB	Core - XVII	Bioethics, Biosafety and IPR	4	1	-	5	60	3	25	75	100	3
24MBP4CV	Core - XVIII	Project and Viva - voce	-	-	16	16	192	-	80	120	200	8
24MBP4DA	DSE - IV	Molecular Diagnostics and Bioinformatics	3	1	-	4	48	3	25	75	100	3
24BCP4DA		Neurobiology										
24BTP4DA		Stem Cell Technology										
Total			11	3	16	30	360				500	17
*Grand Total											2700	92



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EXTRA CREDITS COURSES

Self study paper offered by the Department of Microbiology

S. No.	Semester	Course Code	Course Title
1.	III	24MBPSSA	Good Manufacturing Practices
2.		24MBPSSB	Introduction to Human Anatomy

5/11/24
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 Department of Microbiology
 Dr. N. G. P. Arts and Science College
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BoS- 17th 05.04.24	AC - 17th 17.04.24	GB -



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M.Sc. Microbiology (Students admitted during the AY 2024-25)

Semester – I

CORE: FUNDAMENTALS OF MICROBIOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MBP1CA	FUNDAMENTALS OF MICROBIOLOGY	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none">• History of Microorganisms• Basic techniques in Microbiology• Characteristics of algae, fungi, protozoa and viruses.	
Prerequisite	Knowledge on general characteristics and classification of microorganisms.	
Course Outcomes (Cos)		
CO Number	Course Outcomes (Cos) Statement	Bloom's Taxonomy Knowledge Level
CO1	Explain the theories to understand the importance of microorganisms.	K2
CO2	Apply the principles of sterilization and disinfection. Make use of the types of Media.	K3
CO3	Compare and contrast the principles of Microscopy	K2
CO4	Compare and understand the characteristics of algae, fungi and protozoa.	K3
CO5	Compare and understand the characteristics of viruses.	K3

Mapping with Programme Outcomes					
Cos/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓				
CO2	✓	✓	✓	✓	✓
CO3		✓		✓	✓
CO4	✓	✓			
CO5	✓	✓			



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M.Sc. Microbiology (Students admitted during the AY 2024-25)

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	History of Microbiology: The Historic foundations and development of Microbiology - Spontaneous generation- Germ theory of diseases – Cell theory – Contributions of Antony van Leuwenhoek – Joseph Lister – Robert Koch – Louis Pasteur – Edward Jenner – John Tyndall – Sergei N. Winogradsky – Salmon A. Waksman – Alexander Flemming - Paul Erlich – Fannie Hessie – Elie Metchnikoff, Lederberg and Zinder, Lwoff, Arber and Smith, Temin and Baltimore - Scope of microbiology.	10	Text book 1
II	Sterilization and culturing methods: Sterilization and disinfection - Physical and chemical methods. Culturing of Bacteria – Isolation, purification and Cultivation of different types of Microorganisms -Aerobes and Anaerobes - Culture maintenance and Preservation - Culture Collection centres -ATCC, MTCC and NFMCC.	10	Text book 2
III	Microscopy and Staining: Principles of Microscopy- Light microscope, Inverted microscope, Electron microscope – TEM and SEM, Polarization microscope, Confocal, Perifocal, Atomic force microscope. Stains and staining principles: Simple, Gram, Negative, Capsule, Spore, Flagellar and Acid fast staining.	10	Text book 1
IV	Prokaryotes: Characteristics of Prokaryotic cells – Basic cell types: Prokaryotic cells – Size, shape and Arrangement – Overview of structure – Cell membrane. Internal membrane structure – Cytoplasm- Nucleoid – Inclusions - chlorosomes – carboxysomes - magnetosomes - phycobilisomes -Endospores. External structure – Cell Wall - Flagella and its function – Glycocalyx – Slime layer.	9	Text book 2
V	Protozoa, Viruses, Fungi and Algae: General Characteristics of Protozoa. Structure and Reproduction of Paramecium sp. General Properties of Viruses. Cultivation of Plant and Animal Viruses. Characterization and Enumeration of Viruses-Plant Viruses- CaMV and RNA containing Plant Viruses- TMV. General characteristics of algae- Structure and reproduction of Chlamydomonas sp. General characteristics of fungi Structure and reproduction of <i>Aspergillus niger</i> .	9	Text book 2
	Total	48	



Text Book	1.	Black J G, 2015, Microbiology, 9th Edition, John Wiley and Sons, New Jersey, United States
	2.	Joanne Wiley, Linda Sherwood, Christopher J and Woolverton, 2020, Prescott's Microbiology, 11th Edition, McGraw Hill Company, New York, United States.
Reference Books	1.	Micheal T Madigan, 2018, Brock Biology of Microorganisms, 14th Edition, Pearson Education, New Delhi
	2.	Jeffrey C Pommerville, 2010, Alcamo's Fundamentals of Microbiology, 9th Edition, Jones and Bartlett Publishers, Massachusetts, United States
	3.	Salle A J, 2014, Fundamental Principles of Bacteriology, 7th Edition, Tata Mc Hill Publishing Company Ltd., New Delhi
	4.	Michael Pelczar, 2021, Microbiology, 5th Edition, Tata Mc Hill Publishing Company Ltd., New Delhi.

Journal and Magazines	https://agrimoon.com/wp-content/uploads/Fundamentals-of-Microbiology.pdf
E-Resource and Websites	https://www.basu.org.in/wp-content/uploads/2020/03/Fundamentals-of-Microbiology-1.pdf

Learning Methods	Chalk and Talk/ Seminar/ Assignment
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Focus of the Course	Skill Development/ Employability
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Semester – I

CORE: MICROBIAL PHYSIOLOGY AND BACTERIAL DIVERSITY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MBP1CB	MICROBIAL PHYSIOLOGY AND BACTERIAL DIVERSITY	Core	48	-	-	4

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none">• The physiological, biochemical and metabolic properties of Microorganisms.• The respiratory and nutritional pathways of microorganisms.• The significance of Bacterial diversity.	
Prerequisite	Basic characteristic features and diversification among microorganisms	
Course Outcomes (Cos)		
CO Number	Course Outcomes (Cos) Statement	Bloom's Taxonomy Knowledge Level
CO1	To discuss the nutritional classification of microorganisms based on carbon, energy and electron sources.	K3
CO2	To comprehend nomenclature, classification, kinetics and types of enzymes with an emphasis on nature of enzyme Inhibitions.	K4
CO3	To confer the significance of different pathways of carbohydrate metabolism.	K3
CO4	To acquire the knowledge on the concepts of biosynthesis of amino acids, nucleotides, fatty acids and cell wall of Gram positive and Gram negative bacteria.	K2
CO5	To outline the diversified classes among bacteria.	K5

Mapping with Programme Outcomes					
Cos/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓			✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Nutrition and Growth: Nutritional types of microorganisms - Phototrophs, Autotrophs, Lithotrophs, Organotrophs. Nutritional requirements -Macro, Micro nutrients and trace elements. Membrane transport – passive, facilitated diffusion, active transport (Proton Motive force, PTS, role of permeases), group translocation and ion uptake. Factors affecting Microbial growth – Temperature, pH, Osmosis, Pressure, Oxygen and Radiation. Physiology of Growth – Growth curve. Growth measurements – batch, continuous and synchronous.	10	Text book 1 Reference Book Journals
II	Enzymes and co-enzymes: IUBMB classification and nomenclature of enzymes, active site, Lock and key Mechanism and induced fit hypothesis, Enzyme kinetics - negative and positive. Enzyme inhibition: Reversible – Competitive, Non-competitive, uncompetitive and irreversible inhibition - Feedback inhibition. Regulatory and Allosteric enzymes.	9	Text book 1 Reference Book
III	Energy Production pathways: EMP pathway - Substrate level Phosphorylation - HMP Pathway –Entner Doudroff pathway - Glyoxalate pathway - Krebs cycle. Energy production: Electron transport chain and Oxidative phosphorylation, Pasteur Effect, Bioluminescence. Fermentations of Carbohydrates: Acidic: Homolactic, Mixed acid, Butanediol and Propionic acid fermentation. Alcoholic fermentation: Ethanol. β – Oxidation of Fatty acids.	10	Text book 1 Reference Book Journals
IV	Biosynthesis of Biomolecules: Biosynthesis of Aspartate, pyruvate, histidine and serine amino acid families - Purine and pyrimidine nucleotides - Denovo and salvage pathway. Biosynthesis of fatty acids and lipids. Biosynthesis of gram positive and gram negative cell wall.	9	Text book 1 Reference Book
V	Bacterial Diversity: Introduction to Archaea – Ecology, Cell walls and membranes, Genetics and molecular biology, metabolism. Archaeal taxonomy – Outline characteristics – Crenarchaeota and Euryarchaeota. Methylotrophs – Methanogens. Eubacteria - Photosynthetic bacteria, Cyanobacteria – Spirochaetes - Bacteroidetes. Characteristics of Proteobacteria: Alpha (Rickettsia), Beta (Neisseria), Gamma (Pseudomonas), Delta (Desulfovibrio) and Epsilon (Helicobacter). Low G+C gram positive (Staphylococcus) and High G+C gram positive (Mycobacterium). Case study on Profiling of Microbial Community from different soil.	10	Text book 1 Reference Book Journals
	Total	48	



Text Book	1.	Joanne Wiley, Linda Sherwood, Christopher J and Woolverton, 2016, Prescott's Microbiology, 10th Edition, Mc Graw Hill Company.
Reference Books	1.	David White and George D. Hageman, 2000, Microbial Physiology and Biochemistry Laboratory, Oxford University Press, India.
	2.	Moat. A.G, J.W.Foster, 2002. Microbial physiology. 4th edition. John Wiley & sons. Australia.
	3.	Demain A.J. and Solomon INA, 1999. 2nd edition. Manual of Industrial Microbiology and Biotechnology, ASM press.USA.
	4.	Geoffrey Michael Gadd, 2008, Bacterial Physiology and Metabolism, Cambridge University Press, UK.

Journal and Magazines	https://www.frontiersin.org/journals/microbiology/sections/microbial-physiology-and-metabolism https://journals.plos.org/plosone/
E-Resource and Websites	https://onlinecourses.swayam2.ac.in/cec21_bt17/preview

Learning Methods	Chalk and Talk/ PPT / Seminar/ Assignment
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Focus of the Course	Skill Development/Employability
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Semester – I

CORE: MYCOLOGY, PHYCOLOGY AND LICHENOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MBP1CC	MYCOLOGY, PHYCOLOGY AND LICHENOLOGY	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none">• To acquire knowledge of the diversity of Fungi, Algae, and Lichens• To gain knowledge on the structural organization and reproduction• To obtain knowledge on the importance of Fungi, Algae, and Lichens	
Prerequisite	Knowledge on types and characteristics of microorganisms	
Course Outcomes (Cos)		
CO Number	Course Outcomes (Cos) Statement	Bloom's Taxonomy Knowledge Level
CO1	To introduce diversity, classification and characteristics and acquire knowledge on economic quality of fungi	K4
CO2	To understand the organization and reproduction process of fungi	K3
CO3	To introduce classification, characteristics, and economic quality of algae	K4
CO4	To understand the organization, reproduction, cultivation and various roles of algae in the environment	K4
CO5	To grasp the basic characteristics, classification and economic importance of lichens	K4

Mapping with Programme Outcomes					
Cos/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓		
CO5	✓	✓	✓		✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Classification and Characteristics of Fungi: Classification of fungi (Alexopoulos and Mims, 1979). Recent trends in classification of fungi. General characters of major classes: Mastigomycotina, Schizomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Phylogeny and interrelationships of major groups of fungi. Economic importance of fungi.	10	Text book 1
II	Organization and Reproductions of Fungi: Thallus organization - reproduction, life cycle types, parasexual cycles, reduction in sexuality in fungi - physiological races in fungi - spore dispersal mechanisms and fungal genetics, study of fossil fungi.	10	Text book 2 Reference Book
III	Classification And Characteristics of Algae: Classification of algae (Fritsch, 1945). Salient features of major classes: Chlorophyta, Cyanophyta, Charophyta, Xanthophyta, Phaeophyta and Rhodophyta. Ultrastructure of prokaryotic and eukaryotic algal cells and their components. Economic importance of algae.	8	Text book 1 Reference Book E-book chapters
IV	Ecology, Cultivation and Life Cycle Patterns of Algae: Ecology of algae - algae as pollution indicators, algal blooms, algicides - culture and cultivation of fresh water and marine algae - Knop's solution and Chu-10 medium (1972). Origin and evolution of sex in algae, phylogeny and interrelationships of algae. Lifecycle patterns in algae. Study of fossil algae.	10	Text book 1 Reference Book E books
V	Classification and characteristics of Lichens: Classification of Lichens (Hale, 1969). Occurrence and interrelationship of phycobionts and mycobionts, structure and reproduction in Ascolichens, Basidiolichens, and Deuterolichens. Lichens as indicators of pollution. Economic importance of Lichens. Case Study- Algal diversity and algal bloom in water bodies of your native city or state.	10	Text book 2 Reference Book Journals
	Total	48	



Text Book	1.	Michael Madigan, 2015, Brock Biology of Microorganisms, 14th Edition, Pearson Publishers, New Delhi
	2.	Vashishta BR, Sinha AK, Singh VP, 2010, Botany for Degree students Algae, 1st Edition, S Chand & Company Ltd. India
Reference Books	1.	Alexopoulos CJ, Mims CW, Blackwell M, 2002, Introductory Mycology, 4th Edition, Wiley India Pvt. Ltd, India
	2.	Moore D, Robson GD, Anthony P, Trinci J, 2011, 21st Century Guidebook to Fungi, Cambridge University Press, United Kingdom
	3.	Thomas H. Nash, 2008, Lichen Biology, 2nd Edition Cambridge University Press, India
	4.	Ernst Atheran Bessey, 2020, Morphology and taxonomy of fungi, 1st Edition, Alpha Edition Publishers, India

Journal and Magazines	archive.bio.ed.ac.uk/jdeacon/microbes/fungalwe.html
E-Resource and Websites	https://gclambathach.in/lms/Algae.pdf
	https://gclambathach.in/lms/Algae.pdf

Learning Methods	Chalk and Talk/ Seminar/ Assignment
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Focus of the Course	Skill Development/Employability/Social Awareness and Environment
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Semester – I

CORE: COMPREHENSIVE BIOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MBP1CD	COMPREHENSIVE BIOLOGY	CORE	36	12	-	3

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none">• The structure and function of biomolecules• The basic concepts of developmental biology and cell signalling• The evolution of living cells.	
Prerequisite	Knowledge on fundamentals of cell biology.	
Course Outcomes (Cos)		
CO Number	Course Outcomes (Cos) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the importance of biological molecules.	K3
CO2	Cognize the basic concepts of developmental biology.	K3
CO3	Critically understand the idea on how a cell responds to external stimulus.	K3
CO4	Understand the inheritance of chromosomes.	K3
CO5	Cognize the formation and evolution pattern exhibited till date by living organisms over different time frames.	K3

Mapping with Programme Outcomes					
Cos/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Structure of atoms, molecules and chemical bonds: Composition, structure and function of bio-molecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). Interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction etc.). Principles of biophysical chemistry (pH, buffer, thermodynamics, colligative properties). Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds).	10	Text book 1
II	Basic concepts of developmental biology: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; fertilization and early development.	10	Text book 2
III	Cell Signaling: Cell signaling - Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two component systems, light signaling in plants, bacterial chemotaxis and quorum sensing.	10	Text book 1
IV	Inheritance biology: Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants. Extra chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance. Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.	9	Text book 2
V	Evolution: Emergence of evolutionary thoughts Lamarck; Darwin-concepts of variation, adaptation, struggle, fitness and natural selection; Origin of cells and unicellular evolution: Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiment of Miller; The first cell; Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes; Paleontology and Evolutionary History: The evolutionary time scale; Eras, periods and epoch. Case Study 1: Is there a scenario, where, within the earth, there are locations mimicking the ancient timelines with regards to temperatures (when the globe was formed from the sun due to explosion). If so, are we still witnessing abiotic synthesis even today?	9	Text book 2
	Total	48	



Text Book	1.	Dr. A. P. Singh & Kumar Pushkar, 2021, Upkar CSIR-UGC NET/JRF/SET Life Sciences, 1st Edition, Upkar Prakashan publishers, India.
	2.	Quaisher J. Hossain, Prashant Kumar, Ashish Nagesh, 2018, UGC CSIR NET / SLET (JRF & LS) Life Sciences, 4th Edition, Arihang Publications
Reference Books	1.	Pranav Kumar & Usha Mina, 2020, Pathfinder Academy: CSIR-JRF-NET Life Sciences Book Combo Set with Ecology, 1st Edition, Pathfinder Publication.
	2.	De Robertis, E. D. P, 2017, Cell and Molecular Biology, 8th Edition, Lea & Febiger, New York.
	3.	Van De Graaff, R. Ward Rhee, Sidney L. Palmer, 2013, Schaum's Outline of Human Anatomy and Physiology, 4th Edition, Mcgraw-Hill Companies, New York.
	4.	Michael Pelczar, 2021, Microbiology, 5th Edition, Tata Mc Hill Publishing Company Ltd., New Delhi.

Journal and Magazines	https://www.thebiomics.com/notes/csir/unit-11
E-Resource and Websites	Previous Year NET Life Sciences Question Paper EasyBiologyClass

Learning Methods	Chalk and Talk/ Seminar/ Assignment
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Focus of the Course	Skill Development/ Employability/ Innovations
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Semester – I

CORE: BIO ANALYTICAL TECHNIQUES

Semester	Course Code	Course Name	Category	L	T	P	Credits
1	24MBP1CE	BIO ANALYTICAL TECHNIQUES	Core	36	12	-	3

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none">• To comprehend the principle and instrumentation of diverse instruments for• Microbiology• To procure knowledge on the working methods of different instruments• To appreciate its application in diverse fields	
Prerequisite	Knowledge on bioinstrumentation	
Course Outcomes (Cos)		
CO Number	Course Outcomes (Cos) Statement	Bloom's Taxonomy Knowledge Level
CO1	To understand the principles, instrumentation with an emphasis on applications of Analytical centrifuge.	K3
CO2	To become equipped with the operational principle and working methods of spectral instruments	K2
CO3	To procure knowledge on the principles and techniques of various types of electrophoresis	K3
CO4	To acquaint the concept of radioactivity and its types of decay	K3
CO5	Application of knowledge for the characterization of Biomolecules	K2

Mapping with Programme Outcomes					
Cos/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Centrifugation and Chromatography: Centrifugation: Principles and types - Low speed, High speed and Ultra centrifuge. Applications of Analytical Ultra Centrifugation – Determination of Molecular weight and purity of macromolecules. Chromatography: Instrumentation, detection methods and Applications of TLC, Column, Gas, Ion Exchange, HPLC, Gel Filtration, GCMS and LCMS.	10	Text book Reference Book Journals
II	Colorimetry and Spectrometry: Colorimetry: Principles, Instrumentation, Application and Analysis – Qualitative and Quantitative. Spectrophotometry: Principles, Instrumentation and Applications of UV, Visible, IR, NMR, FTIR, Atomic absorption, Mass Spectroscopy and MALDI – TOF, Spectrofluorometry and Flame Photometry	9	Text book Reference Book
III	Electrophoresis: Principles and Instrumentation - Separation of Nucleic acids – Agarose Gel Electrophoresis, Electrophoresis of RNA, Capillary Electrophoresis and Microchip Electrophoresis. Separation of Proteins – SDS – PAGE, Native Gel, Gradient Gel, Iso Electric Focusing, 2D Page, Cellulose Acetate Electrophoresis, Western Blotting - Detection, Estimation and Recovery of Proteins in gel.	10	Text book Reference Book
IV	Radiometry: Introduction - Detection and Measurement of Radioactivity –Detection based on gas ionization - Autoradiography and its applications – Scintillation Counting - Safety Aspects – Biosensors and its applications (DNA and Immunosensors).	9	Text book Reference Book
V	Quantification Methods for Biomolecules: Quantitative determination of Macromolecules: Carbohydrates (DNSA and Anthrone method), Lipids (Gravimetric), Protein (Lowry and Bradford method). Determination of Molecular weight of protein (MS and SDS-PAGE) and DNA (Agarose gel). Estimation of Microbial pigments: Chlorophylls and Carotenoids. Case study - Collect the various plant leaves from our college campus and analyze their compounds using chromatography techniques.	10	Text book Reference Book Journals
	Total	48	



Text Book	1.	L Veerakumari, 2011, Bioinstrumentation, First Edition, MJB Publishers.
Reference Books	1.	Keith Wilson and John Walker, 2010, Principles and Techniques of Biochemistry and Molecular Biology, Seventh edition, Cambridge University Press
	2.	Plummer .T David, 2004, An Introduction to Practical Biochemistry, Third Edition, TMH Publishers
	3.	Rodney Boyer, 2000, Modern Experimental Biochemistry, Third Edition, Pearson education Publishers
	4.	Swahney S K and Singh R, 2014, Introductory Practical Biochemistry, Narosa Publishing House

Journal and Magazines	http://www.omicsonline.org/analytical-bioanalytical-techniques.php
E-Resource and Websites	https://www.aminotes.com/2017/09/bioanalytical-techniques-study-material.html

Learning Methods	Chalk and Talk/ Seminar/ Assignment
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Focus of the Course	Skill Development/Employability/Entrepreneurship
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24MBP1CP	CORE PRACTICAL: BASIC TECHNIQUES IN MICROBIOLOGY	SEMESTER I
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Total Credits: 3
Total Instructions Hours: 72 h

S.No	Contents
1	Bacterial Staining techniques - Gram, Acid-fast, Spore, Capsule and Negative Staining.
2	Morphological observation of Fungi -LPCB Mount.
3	Micrometry – Measurement of Microorganisms.
4	Motility determination- Hanging drop and soft agar inoculation.
5	Enumeration of Microorganisms from soil: Bacteria, Fungi and Actinomycetes.
6	Determination of Bacterial generation time - Direct microscopic method and turbidity method
7	Effect of various intrinsic factors on the growth of bacterium – pH, Temperature
8	IMViC test, Hydrogen sulphide test, Oxidase test, Calalase test, Urease test
9	Preferential utilization of sugar - Carbohydrate fermentation & TSI; Polymer degradation – Starch, Casein
10	Quantitative determination of Sugar by DNSA method and Protein by Lowry et al method
11	Separation techniques: Chromatography- TLC and Column.
12	Microscopic observation of Algae and Lichen thallus

Note: Out of 12-10 Mandatory



References

- 1 James Cappuccino, Natalie Sherman, 2013, **Microbiology: A Laboratory Manual**, 10th Edition, Pearson Publishers
- 2 Aneja. K.R, 2012. **Experiments in Microbiology, Plant Pathology and Biotechnology**, 2nd edition. New age publisher
- 3 Rajan S. Selvi Christy.R, *Experimental Procedures in Lifesciences*, CBS Publishers & Distributors Pvt Ltd
- 4 Kannan, N, 1997, **Laboratory Manual of General Microbiology**, 1st Edition, Panima Publishing house



Semester – I

DSE I: MICROBIAL TECHNOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MBP1DA	MICROBIAL TECHNOLOGY	DSE	36	12	-	3

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none">• The production of Sustainable products using Microorganisms.• The importance of Microorganisms in Pharmaceutical sector.• How to explore the ideas in commercial level	
Prerequisite	Knowledge on microbial products and their mass production	
Course Outcomes (Cos)		
CO Number	Course Outcomes (Cos) Statement	Bloom's Taxonomy Knowledge Level
CO1	Inculcate about microbial products and its scale up production through establishing a small scale industry	K2
CO2	Exemplify the ideas about the production and uses of Biofuel and Biofertilizer.	K3
CO3	Demonstrate the commercial production of Biopolymers using Microorganisms.	K4
CO4	Understand the way of cells and enzymes were immobilized for industrial uses.	K3
CO5	Explore the pharmaceutical products and possibilities of converting it to a commercial product.	K4

Mapping with Programme Outcomes					
Cos/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓	✓	✓
CO2	✓	✓		✓	✓
CO3	✓		✓	✓	✓
CO4	✓		✓		✓
CO5	✓	✓		✓	✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Single Cell Protein and its Economic Aspects: Bacterial, Yeast, Fungal and Algal Proteins –Brewer's and Baker's yeast – Food and Fodder yeast – Mushroom (<i>Agaricus</i> , <i>Oyster</i>) and Products from Higher fungi (<i>Ganoderma lucidum</i>).	9	Text book Reference Book Journals
II	Production of Biofuel & Biofertilizer: Production, Methods and Uses of Bioethanol (<i>S. cerevisiae</i>) – Biodiesel (<i>Chlorella</i>) – Biohydrogen (<i>Chlamydomonas</i>) – Biogas (Methanobacteria). Biofertilizer - N ₂ fixing, Phosphate Solubilizing, Phosphate Mobilizing, Plant Growth Promoting Rhizobacteria - Mass production and Applications.	9	Text book Reference Book
III	Biopolymer production: Production and Uses of Polyhydroxybutyrate (PHB) – Xanthan – Alginate – Cellulose –Cyanophycin – Levan - Melanin - Welan - Succinoglucan- Curdlan- Chitosan -Polyhydroxyalkanoates - Hyaluronic acid.	9	Text book Reference Book
IV	Immobilization of Cells & Enzymes: Cells – Surface attachment of cells – Entrapment - Hydrogel method, Preformed support materials – Containment behind a barrier: Microencapsulation, Immobilization using membranes – Self aggregation of cells –Methods for Enzyme immobilization – Carrier binding method, Intermolecular cross linking – Applications of Immobilized cells and Enzymes.	10	Text book Reference Book
V	Microbial products with pharmaceutical importance: Vaccines – Steps of Manufacturing – Growing the microbes and separation – Preparation of Live and killed vaccine – Preparation of Toxoid and uses – BCG Vaccine – Cholera vaccine – Rabies vaccine – Diphtheria toxoid. Pharmaceutical industry - certification & accreditation required. Bioentrepreneurship opportunities and Funding sources - Government funds, Venture capital, NGOs, Crowd funding and Incubation centers. Antimicrobial compounds from soil microbes -Case study	11	Text book Reference Book Journals
	Total	48	



Text Book	1.	Patel A H, 2012, Industrial Microbiology, 2 nd Edition, Trinity Press, New Delhi
Reference Books	1.	El-Mansi E M T, Bryce C F A, Dahhou B, Sanchez S, Demain A L and Allman A R, 2012, Fermentation Microbiology and Biotechnology, 3 rd Edition, CRC Press, USA
	2.	Bernard R Glick, Jack J Pasternek and Cheryl L Patten, 2010, Molecular Biotechnology -Principles and Applications of Recombinant DNA, 4 th Edition, ASM Publishers, USA]
	3.	Nidhi Goel, 2013, Pharmaceutical Microbiology, 1 st Edition, Narosa Publishing House, New Delhi.
	4.	Puvanakrishnan R, Sivasubramanian S and Hemalatha T, 2012, Microbial Technology -Concepts and Applications, 1 st Edition, MJP Publishers, New Delhi

Journal and Magazines	https://link.springer.com/ https://aem.asm.org/
E-Resource and Websites	https://www.microbialbiotechnology.com/ https://www.asmscience.org/content

Learning Methods	Chalk and Talk/ Seminar/ Assignment
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Focus of the Course	Skill Development/Employability/Entrepreneurial Development/Innovations/Intellectual Property Rights
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SEMESTER I
DSE I: CANCER BIOLOGY, DIAGNOSIS AND THERAPY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24BCP1DA	CANCER BIOLOGY,DIAGNOSIS AND THERAPY	DSE	36	12	-	3

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none"> • Molecular basis of cancer, mutations causing cancer, and repair mechanisms • The basic principles of cancer development and available therapeutic options • The different diagnostic and treatment methods for cancer.
Prerequisite	Basic knowledge about cell biology

Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Compare and contrast benign and malignant tumors and the morphological characteristics of cancer cells.	K4
CO2	Justify the molecular basis of cancer. Distinguish interdisciplinary areas in cancer biology.	K5
CO3	Evaluate the molecular mechanism of oncogenesis, tumor biology and the role of cell cycle in cancer.	K5
CO4	Validate the role of tumor suppressor genes and apoptosis. Explain about epigenetics.	K5
CO5	Summarize on the choice of diagnosis and therapy available for cancer patients.	K6

Mapping with Program Outcomes:					
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Introduction: Cancer cell-morphology and growth characteristics. Metastasis and cytoskeleton. Apoptosis. Types and prevalence of cancer. Nomenclature of neoplasms, classification based on origin/organ. Differences between benign and malignant tumors.	09	Text Book
II	Cancer epidemiology and endocrinology. Cancer causing agents- radiation, viruses, chemicals. Multistep carcinogenesis: Initiation, Promotion, Progression. Para-neoplastic syndromes. Mutation- definition, significance, rates and frequency. Mutagenic agents. Molecular basis of mutagenesis: induced and spontaneous mutations, crossing over and segregation. Cancer genetics. Chemical carcinogenesis- genetic and epigenetic carcinogens, pro-carcinogens and co- carcinogens, promoters and initiators, testing for carcinogenicity, Ames test. Aberrant metabolism during cancer development.	09	Reference Book
III	Oncogenes - RNA and DNA tumor viruses, retroviruses and viral oncogenes and abrupt activation. Src and Ras gene, mechanism and characteristic of cell transformation. Molecular mechanism of oncogenesis- protooncogenesis, oncoproteins, tumor suppressor genes involved in cancer. Radiation- effect of ionizing radiations on DNA, chromosomal aberrations. Cancer Markers: Genetic basis of cancer, use of tumor markers in detection and monitoring of cancer. Signal transduction in cancer: cell-cell interactions, cell adhesion, invasion and metastasis, VEGF signaling and angiogenesis; role of transcription factors. Growth factors- EGF, TNF- α and TGF- β and growth factor receptors. Free radicals and antioxidants in cancer. Diet and cancer.	10	Reference Book
IV	Cell Cycle Regulation cancer: control of the cell cycle - cyclins and CDKs, and tumor suppressor genes p53, p21Rb, BRAC1 and BRAC2. Telomeres, and Immortality; Epigenetics- role of DNA methylation in gene silencing- epigenetic silencing of tumor - suppressor genes.	10	NPTEL
V	Principles and methods of cancer diagnosis - biochemical, genetic, cytotoxic, cell growth and viability tests. Diagnosis of cancer by histopathology, MRI scans, PET scan, cytogenetics test, karyotype, FISH. Strategies of anticancer drug therapy- chemotherapy, gene therapy, immuno therapy, radiotherapy and surgical therapy. Principles of cancer biomarkers and their applications.	10	You Tube Videos
	Total	48	



Text Book	1.	Mc Kinnell R.G et al, 2012, "The Biological Basis of Cancer", Second edition, Cambridge University Press, London.
Reference Books	1.	Weinberg R.A, 2014, "The Biology of Cancer", Second edition, Garland Science, New York & London.
	2.	Vincent T. De Vita M. D et al, 2020, "Principles and Practice of Oncology: Primer of Molecular Biology in Cancer", Third edition, Lippincott Williams and Wilkins, Philadelphia.
	3.	Pelengaris S and Khan M, 2010, "The Molecular Biology of Cancer - A bridge from bench to bed side", Second edition, Wiley Black well, London
	4.	Hesketh R, 2013, "Introduction to Cancer Biology", First edition, Cambridge University Press, London.
	5.	Pezzella F et al, 2019, "Oxford textbook of Cancer Biology", First edition, Oxford University Press, London

Journal and Magazines	https://journals.lww.com/amjclinicaloncology/pages/default.aspx
E-Resources and Website	https://www.cancer.gov/research/resources ; https://nptel.ac.in

Learning Methods	Chalk and Talk/Assignment/Seminar
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Focus of the Course	Skill Development/Employability
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Semester - I
DSE I: APPLIED BIOTECHNOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24BTP1DA	APPLIED BIOTECHNOLOGY	DSE	36	12	-	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> • The applications of biotechnology in plant , animal and Environmental field the basic concept of sequence and series • The applications of biotechnology in health care sector • The products obtained from fermentation and its applications
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Prerequisite	Knowledge on Applied Biotechnology
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Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the fundamental applications of Biotechnology	K2
CO2	Know the basics and fundamentals of biotechnology applications in environment	K2
CO3	Discuss about the disease and disease prevention	K3
CO4	Discuss the applications of Enzymes in various fields	K4
CO5	Discuss the production and application of products obtained from fermentation technology	K2

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	
CO2	✓		✓	✓	✓
CO3			✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Agricultural, Plant Biotechnology and Animal Biotechnology: Applications of transgenic crop technology: Herbicide resistance (Glyphosate Resistance plants), Pest resistance (Bt Cotton) and Virus Resistance. Enhancement of micro-nutrients (Vitamin A). Delayed Fruit Ripening. Molecular pharming in plants. Transgenic animals (Transgenic mice and Transgenic cattle). Production and recovery of products from animal tissue cultures (Blood clotting factors, Growth hormones, insulin)	10	Text Book - 1
II	Environmental Biotechnology: Bioremediation- (Bioaugmentation and Biostimulation). Biodegradation of Xenobiotic compounds. Bioleaching. Microbially Enhanced Oil Recovery. Biotechnological methods for hazardous waste management. Bioindicators –Biomarkers –Biosensors – Management of effluent toxicity, heavy metal pollution, thermal and radioactive pollution	08	Reference Book - 2
III	Health Care Biotechnology: Disease prevention – vaccines: conventional vaccines, purified antigen vaccines, recombinant vaccines, DNA vaccines, synthetic vaccines. Disease Diagnosis – Probes, monoclonal antibodies and detection of genetic diseases. Disease treatment – interferons, monoclonal antibodies. Gene therapy, enzyme therapy and replacement. Forensic medicine.	10	Reference Book -3
IV	Enzyme Biotechnology: Enzymes used for diagnostic purpose- (acid phosphatase, alanine aminotransferase and alkaline phosphatase). Cardiac Biomarkers. Enzymes used for screening liver and kidney diseases. Enzymes used in food industry, leather industry, wool industry, dairy industry and textile industry.	10	Reference Book – 2 and NPTEL
V	Fermentation Biotechnology: Production, harvest, recovery and uses – enzymes, antibiotics (Tetracycline), vitamins (B2), aminoacids (glutamic acid), organic solvents (ethanol); organic acids (lactic acid). Single cell protein (algae), beverages (Wine). Formulation of Biofertilizer (Rhizobium), Biopesticides.	10	You Tube Videos and Reference Book - 4
	Total	48	




Text Book	1.	Bernard R Glick and Jack J Pasternak, 2010, "Molecular Biotechnology: Principles and Applications of recombinant DNA", 4 th Edition, ASM Press
Reference Books	1.	Marwaha S S & Arora K, 2000, "Food processing: Biotechnological application", Asiatech Publishers INC, New Delhi.
	2.	Palmer T, Bonner PLR, 2014, "Enzymes: Biochemistry, Biotechnology and Clinical Chemistry", 2 nd Edition, Woodhead Publishing Limited, Oxford..
	3.	Owen, Jenni Punt and Sharon A Stranford, 2013, "Kuby Immunology", 7 th Edition, W.H. Freeman and Company, New York.
	4.	Stanbury PF and Whitaker A, 2007, "Fermentation microbiology and Biotechnology", 2 nd Edition, Taylor and Francis.

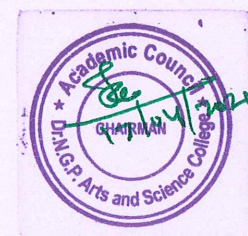
Journal and Magazines	https://www.macrothink.org/journal/index.php/jab , https://link.springer.com/journal/12010
E-Resources and Website	https://www.keaipublishing.com/en/journals/biotechnology-notes/ https://www.drishtias.com/to-the-points/paper3/biotechnology-and-its-applications https://nptel.ac.in

Learning Methods	Chalk and Talk/Assignment/Seminar
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Focus of the Course	Entrepreneurial Development /Employability
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Signature
5/4/24
BoS Chairman/HOD
Department of Microbiology
Dr. N. G. P Arts and Science College
Coimbatore - 641 048

 Dr.N.G.P Arts and Science College		
APPROVED		
BoS- 17th 05.04.24	AC - 17th 17.04.24	GB -



Dr.NGPASC

COIMBATORE | INDIA

M.Sc. Microbiology (Students admitted during the AY 2024-25)

Semester - II CORE: MICROBIAL GENETICS							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24MBP2CA	MICROBIAL GENETICS	CORE	48	-	-	4

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> the fundamentals behind classical genetics. mechanisms of gene replication and expression. the knowledge of Genetic material exchange and mutations.
Prerequisite	Knowledge on Basics of Microbial physiology

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the biological process by a historical approach to study classical systems of gene regulation in bacteria.	K2
CO2	Understand the topology of DNA and RNA, and evaluate the molecular mechanisms of DNA replication.	K2
CO3	Apply the principles of transcription and translation in gene expression.	K3
CO4	Compare the mutational types, DNA repair mechanisms, and apply the molecular markers to study the microbial diversity.	K4
CO5	Apply the horizontal gene transfer concepts in mapping of genes.	K3

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓	✓		✓
CO3	✓	✓		✓	
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓



24MBP2CA	MICROBIAL GENETICS
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Syllabus

Unit	Content	Hrs	Resources
I	Classical Genetics Mendel's Laws: Monohybrid - Dihybrid - Test cross, concept of dominance, segregation, independent assortment; Chromosome theory of inheritance. Chromosomes & crossing over. Sex-influenced and limited inheritance. Chromatin structure and organization.	10	Text Book 1 and 2
II	DNA and RNA DNA and RNA as genetic material. Nucleic Acid chemical composition, C value paradox, Physical structures of DNA, Circular and Superhelical DNA. RNA Structure and types. DNA Replication - Basic rule for replication of all nucleic acids - Geometry of DNA replication - Enzymology.	10	Text Book 1 and 2
III	Gene Expression Transcription: Transcription in prokaryotes and eukaryotes - structures of rRNA, tRNA and mRNA. Inhibitors of transcription. Reverse Transcription. Antisense RNA and its significant. Genetic code. Translation - Transfer of RNA and aminoacyl synthetases - codon, anticodon interactions - Wobble hypothesis. Post transcriptional and translational modification.	10	Text Book 1 and Reference Book 1
IV	Mutation and Molecular Markers Mutation - types of Mutation -Spontaneous and induced mutation. Mutagenesis- Physical and Chemical. DNA repair mechanisms: Photo reactivation - Excision repair - Recombination repair - SOS repair. Molecular Markers, RFLP, RAPD, AFLP and Isozyme Loci. CRISPR gene editing.	9	Reference Book 1
V	Gene transfer Mechanisms of Gene transfer in bacteria - Transformation - Transduction and Conjugation. Phage genetics, Phage T mutants, Genetic recombination, Genetic mapping of T4 Phage. Regulation of gene activity - Operon model- positive and negative operon: (Lac, Trp), Autoregulation - translational regulation. Case study: Consider that you have isolated a rod shaped bacterium from a sewage sample that has the potential of adapting to different environments. You have to analyze the up-regulation and down-regulation of different genes for different growth conditions through restrictive digestion.	9	Reference Book 1
Total		48	



Text book	1.	Freidfelder,D 1995, Microbial genetics. 1st Edition. New Delhi: Narosa Publishing House.
	2.	Gardner, E. J, Simmons, M J and D P Snustard, 2006, Principles of Genetics, 8th Edition, John Wiley and Sons, New York.
Reference Books	1.	Klug .W.S. and Cummings, M.R., 2016, Essentials of Genetics, 9th Edition, New Delhi: Pearson Publishers.
	2.	Larry Snyder, Joseph E. Peters, Tina M. Henkin, 2013, Molecular Genetics of Bacteria, 4th Edition, Wendy Champness, ASM Press.
	3.	David Freifelder, 2000, Microbial Genetics, 7th Edition Narosa Publishing House, New Delhi.
	4.	Jocelyn E. Krebs, Elliott S. Goldstein. Stephen T. Kilpatrick, 2014, Lewin's Genes - X, 11th Edition, Jones and Bartlett Learning.
	5.	Freifelder,D 2004, Molecular Biology. 1st Edition, New Delhi: Narosa Publishing House

Journal and Magazines	<u>Microbial genetics - Latest research and news</u> <u>Nature</u>
E-Resources and Website	<u>Microbial genetics</u> <u>Open Library</u>

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations / Intellectual Property Rights / Social Awareness/ Environment
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Semester - II							
CORE: IMMUNOLOGY AND IMMUNOTECHNIQUES							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24MBP2CB	IMMUNOLOGY AND IMMUNOTECHNIQUES	CORE	48	-	-	4

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> the structural features of the components of the immune system. the functions of Immune system. the mechanisms involved in Immune system development and responsiveness.
Prerequisite	Knowledge on microbes and allergens acting as antigens

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Apply the knowledge of immune cells and organs in immune profiling.	K3
CO2	Understand the basis of immune response and properties of antigen and antibodies.	K2
CO3	Evaluate the Immuno-diagnostic methods for effective diagnosis.	K4
CO4	Assess the level of immune-regulation during microbial infection.	K4
CO5	Conclude the efficient HLA matching of donor and recipient in transplantation.	K4

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓		✓	✓
CO5	✓		✓		✓



24MBP2CB	IMMUNOLOGY AND IMMUNOTECHNIQUES
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Syllabus

Unit	Content	Hrs	Resources
I	History and Scope of Immunology Historical background and scope of Immunology, Defence mechanisms of human body - First line defence - Anatomical and Physiological barriers - Second line defence - Fever, inflammation and Phagocytosis - Third line defence - Cells and organs of immune system.	10	Text Book 1 and 2
II	Immunity & Types Immunity - types of immunity - Natural, acquired, specific and non-specific, cell mediated and humoral, active and passive immunity. Antigens - properties, Epitopes, haptens, adjuvant, cross reactivity. Antibodies - properties, structure (primary & secondary) and isotypes. Diversity and specificity. Anti-antibodies. Complement pathway.	10	Text Book 1 and 2
III	Antigen-Antibody reactions Serology - Antigens and antibody reactions - Introduction and classification of antigens and antibody reactions - Agglutination and precipitation reaction. Strength of antigen and antibody binding - affinity & avidity. Therapeutic applications of monoclonal antibodies and Complement fixation reaction. Immunofluorescence, RIA, RAST, ELISA and Flow cytometry - RT-PCR.	10	Text Book 1 and Reference Book 1
IV	Lymphocyte Response Response of B-cell and T-cell to antigens. B-cell and T-cell products. Hyper sensitivity - Type I, II, III and IV - MHC antigens - types and functions. Immunity to infectious diseases - Viral, bacterial and protozoan.	9	Reference Book 1
V	Transplantation Immunology Transplantation immunology - Tissue transplantation and grafting - Mechanism of graft acceptance and rejection - HLA typing - Tumor immunology - Immunodeficiency disorders - Primary (SCID) and Secondary (AIDS) and auto immunity. Vaccines - Types and vaccination methods. Case Study on vaccines for Covid'19.	9	Reference Book 1
Total		48	



Text book	1.	Roitt IM, 2017, Essential Immunology, 13th Edition, Wiley-Blackwell Publishers, United States.
	2.	Kuby, 2018, Immunology, 8th edition, W.H.Freeman Publishers, New York.
Reference Books	1.	Tizard I R, 1995, Immunology an Introduction, 4th Edition, Saunders College Pub, United States.
	2.	Raif S. Geha and Luigi D. Notarangelo, 2016, Case Studies in Immunology: A Clinical Companion, 7th Edition, Garland Science Publishers, United States.
	3.	Lauren M. Sompayrac, 2019, How Immune System Works, 6th Edition, Wiley Blackwell, United States.

Journal and Magazines	<u>The Journal of Immunology American Association of Immunologists</u> <u>Immunology - Wiley Online Library</u>
E-Resources and Website	<u>Immunology Notes - Microbe Notes</u>

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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Semester -II CORE: VIROLOGY							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24MBP2CC	VIROLOGY	CORE	48	-	-	4

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> to get the basic knowledge on general properties of viruses to impart knowledge on bacterial, plant and animal viruses and their diagnosis. the role and production of conventional and modern viral vaccines and their mode of action
Prerequisite	Knowledge on general characteristics of viruses

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Classify viruses systematically.	K3
CO2	Analyse and interpret the properties of plant viruses bacteriophages.	K4
CO3	Evaluate and distinguish animal viruses	K4
CO4	Criticize the Routine and Molecular Diagnosis with special reference to Virology.	K4
CO5	Design attenuates and recombinant viral vaccines.	K4

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		✓
CO2	✓	✓		✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓		✓
CO5	✓		✓	✓	✓



24MBP2CC	VIROLOGY
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Syllabus

Unit	Content	Hrs	Resources
I	Introduction to Viruses General properties and Baltimore system of Virus classification. Cultivation and purification of viruses - Principles of bio-safety, containment facilities, maintenance and handling of laboratory animals and requirements of virology laboratory. Basic immune response to viral infection. Virions and Prions.	9	Text Book2 E books
II	Bacteriophages and Plant Viruses Structure, genome replication, Lytic and lysogenic cycle of bacteriophages, protein synthesis and assembly of DNA containing bacteriophages - T4, lambda, Mu, ΦX174 and M13 phages - RNA containing bacteriophages - MS2 and Φ6 group. Plant viruses - CaMV and Gemini Virus - RNA containing plant viruses - TMV, Cowpea mosaic viruses, Bromo mosaic viruses and Satellite viruses.	9	Text Book1 Reference book 3
III	Animal Viruses Mechanism of viral entry, multiplication and release from host cell. Pathogenicity of DNA containing animal viruses - Adeno viruses, Herpes viruses, Pox viruses, RNA containing animal viruses - Rhabdo virus, Hepatitis viruses, Orthomyxo virus, H1N1, Paramyxovirus, HIV and Rubella virus. Emerging foodborne viruses a case study- Noro virus and Hepatitis a virus (HAV).	10	Text Book1 Reference Book 1
IV	Diagnostic Methods Immunodiagnosis - Staining and microscopy for viral inclusion bodies analysis by Electron microscopy, Haemagglutination, Complement fixation, Neutralization, Western blot, RIPA, Flowcytometry and Immunohistochemistry. Nucleic acid based diagnosis - Nucleic acid hybridization, Polymerase chain reaction, Microarray to detect protein and nucleotides.	10	Text Book1 Journals
V	Prophylaxis Viral Vaccines - Conventional vaccines and recombinant vaccines immunomodulators (cytokines). Antivirals - Interferon: Definition and its types, Mass production of Interferon, anti retrovirals - mechanism of action and drug resistance. Modern approaches of virus control - Anti-sense RNA, siRNA. Case Study: A 25-year-old female living in a tropical region presents with a sudden high fever, severe headache, retro-orbital pain, muscle and joint pain, and a rash. She mentions having been bitten by mosquitoes frequently in the past few	10	Text Book1 Reference book 1 & 2 E books Journals



	days. Laboratory tests confirm the presence of Dengue virus RNA in her blood. What preventive measures can be taken to reduce the risk of Dengue virus transmission? What is the treatment approach for a patient with Dengue fever?		
	Total	48	

Text book	1.	Dimmock N J, Easton A J, and Leppard K N, 2016, Introduction to Modern Virology, 7th Edition, Blackwell publishing, New Jersey..
	2.	Stainier R V, Ingraham J L, Wheelis M L and Painter P R, 1992, The General Microbiology, 5th Edition, Macmillan, Hampshire and London.
Reference Books	1.	Ananthanarayanan R and CK Jayaram Panicker, 2017, Introduction to Medical Microbiology, 10th Edition, The Orient Longman, New Delhi.
	2.	Black J G and Black LJ, 2017, Microbiology - Principles and Explorations, 10th Edition, John Wiley and Sons Inc. New York.
	3.	Rogger Hull, 2001, Mathews Plant Virology, 4th Edition, Academic Press, New Delhi.
	4.	<a)"="" href="https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology_(Boundless)/7%3AMicrobial_Genetics.">https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology_(Boundless)/7%3AMicrobial_Genetics.)

Journal and Magazines	<a)"="" href="https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology_(Boundless)/7%3AMicrobial_Genetics.">https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology_(Boundless)/7%3AMicrobial_Genetics.)
E-Resources and Website	<a)"="" href="https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology_(Boundless)/7%3AMicrobial_Genetics.">https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology_(Boundless)/7%3AMicrobial_Genetics.)

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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Semester - II CORE : MEDICAL BACTERIOLOGY							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24MBP2CD	MEDICAL BACTERIOLOGY	CORE	36	12	-	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> the indigenous microbial flora the principle of Gram positive and Gram negative organisms the importance of zoonotic diseases.
Prerequisite	Knowledge on basic characteristics of microorganisms

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Apply the epidemiological concepts in identifying the etiology of disease outbreak.	K3
CO2	Analyze and identify the gram positive bacterial pathogens from clinical samples.	K4
CO3	Analyze and identify the gram negative bacterial pathogens from clinical samples	K4
CO4	Analyze and identify the other significant bacterial pathogens from clinical samples.	K4
CO5	Develop infection control policy, antimicrobial sensitivity and resistance pattern of pathogenic bacteria and waste disposal.	K4

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓		✓
CO5	✓	✓	✓		✓



24MBP2CD	MEDICAL BACTERIOLOGY
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Syllabus

Unit	Content	Hrs	Resources
I	Indigenous normal Microbial flora Indigenous normal microbial flora of human body. General attributes and virulence factors of bacteria causing infections. Epidemiology of infections. Host Parasite relationships – Nonspecific host immune mechanisms. Ground rules for collection and dispatch of clinical specimens for microbiological diagnosis.	10	Text Book 1 and Reference Book 2
II	Gram Positive organisms Gram positive organisms - Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of <i>Staphylococcus aureus</i> , <i>Streptococcus pyogenes</i> , <i>Pneumococcus</i> , <i>Bacillus anthracis</i> , <i>Corynebacterium diphtheriae</i> , <i>Mycobacterium tuberculosis</i> , <i>Mycobacterium leprae</i> . Role of cell signaling and quorum sensing in microbial diseases	8	Text Book 2
III	Gram Negative organisms Gram negative organisms - Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of <i>E. coli</i> , <i>Klebsiella pneumoniae</i> , <i>Salmonella typhi</i> , <i>Shigella dysenteriae</i> , <i>Pseudomonas aeruginosa</i> , <i>Vibrio cholerae</i> , <i>Bordetella pertussis</i> , <i>Neisseria gonorrhoeae</i> , and <i>Neisseria meningitidis</i> , <i>Brucella abortus</i> .	10	Text Book 1
IV	Miscellaneous bacteria A detailed account of cultural and morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Actinomycetes (<i>Actinomyces</i> and <i>Nocardia</i>) and Spirochaetes (<i>Treponema</i> , <i>Borrelia</i> , <i>Leptospira</i>), <i>Brucellae</i> , <i>Listeria</i> , <i>Monocytogenes</i> , <i>Mycoplasma</i> , <i>Rickettsia</i> , <i>Chlamydiae</i> , <i>Campylobacter</i> and <i>Helicobacter pylori</i> .	10	Text Book 2 and Reference book 3,4
V	Zoonotic diseases Zoonotic diseases and their control – Hospital acquired infections – Hospital Infection control committee – functions. Hospital waste disposal – Plastic, Gloves and Paper. Ethical committee – functions. Antimicrobial resistance and Multi drug resistance. Case Study: A 35-year-old man presented with abdominal pain and bloody diarrhea. He experienced fever, chills, nausea and vomiting. A stool culture was sent to the microbiology laboratory. Identify the organism and its importance in causing infection.	10	Text Book 2
Total		48	



Text book	1.	Ananthanarayan R and Paniker C. K. J, 2020, Textbook of Microbiology , 11th Edition, Universities press pvt. Ltd.
	2.	Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. 2013, Jawetz, Melnick and Adelberg's Medical Microbiology , 26 th edition. McGraw Hill Publication
Reference Books	1.	Goering R., Dockrell H., Zuckerman M. and Wakelin D, 2007, Mims' Medical Microbiology , 4 th Edition. Elsevier.
	2.	Willey JM, Sherwood LM, and Woolverton CJ, 2013, Prescott, Harley and Klein's Microbiology , 9 th Edition. McGraw Hill Higher Education
	3.	Madigan MT, Martinko JM, Dunlap PV and Clark DP, 2014, Brock Biology of Microorganisms , 14 th Edition. Pearson International Edition.
	4.	ARORA D.R. 2017, TEXTBOOK OF MICROBIOLOGY , 5th edition, CBS publisher.

Journal and Magazines	https://www.sciencedirect.com/journal/international-journal-of-medical-microbiology
E-Resources and Website	https://microbiologyinfo.com/category/bacteriology/

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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Semester – II CORE : RECOMBINANT DNA TECHNOLOGY							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24MBP2CE	RECOMBINANT DNA TECHNOLOGY	CORE	36	12	-	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> the utilization of different DNA manipulating enzymes and its exploitation for beneficial applications. the development of clones and transform them into organisms, making them to produce new products. how to utilize the microbial system in developing products of commercial importance.
Prerequisite	Knowledge on Genetic Recombination

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Apply the ideas of restriction modification system, towards evolution of recombinant DNA technology	K3
CO2	Reframe different vectors in the development of new recombinants	K4
CO3	Employ transport vectors for producing recombinant cells	K4
CO4	Measure and screen the recombinants	K4
CO5	Synthesize commercially important products of microbial origin by rDNA techniques	K4

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓



24MBP2CE	RECOMBINANT DNA TECHNOLOGY
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Syllabus

Unit	Content	Hrs	Resources
I	Enzymology of rDNA Technology History and Scope of rDNA technology - Restriction modification system. Enzymes involved in rDNA techniques, its classification, cofactor involved and mode of action - Restriction endonuclease, Restriction Exonuclease, Polymerases, Klenow, DNA dependent RNA polymerase, Ligase, Reverse Transcriptase, Terminal Transferase, polynucleotide kinase, alkaline phosphatase.	10	Text Book 1
II	Vectors Introduction to vectors and types - Host cells and vectors - Host cell types (prokaryotic and eukaryotic) - plasmid vectors (host range and incompatibility) pBR322, pUC18/19; Phage based vectors - M13 and Lambda; cosmids; phagemids; fosmid; Artificial chromosomes - BACs; Eukaryotic vectors - YAC; Shuttle vectors; plant vectors; (Ti plasmid based vectors and caulimoviral vector) - Expression vectors for prokaryotes and eukaryotes; Vectors with tags - Histidine tags.	10	Text Book 1
III	Cloning and Transformation Cloning strategies - DNA cloning a) Sticky ends b) Blunt ends c) Homopolymeric tailing d) Use of adapters and linkers; Construction of genomic DNA libraries (shotgun cloning) and cDNA libraries; Gene transfer techniques in plants, animals and microbes - Transformation, electroporation, microprojectile system, liposome mediated transfer, gene gun etc.,	10	Text Book 1
IV	Screening and characterization of cloned DNA Screening: Direct: Antibiotic resistance, lacZ complementation (Blue-white selection), plaque phenotype; Indirect: Immunochemical detection - Nucleic acid hybridization, Blotting - Dot and Colony Blotting; Chromosome walking. Chromosome jumping. Characterization of clones - Restriction mapping - restriction fragment length polymorphism (RFLP) - Polymerase chain reaction (PCR) - Types of PCR and their applications. DNA sequencing: Primer walking, Maxim and Gilbert method, dideoxy method and micro array.	9	Text Book 2 and Reference Book 1
V	Applications Gene silencing techniques: Introduction to siRNA and siRNA technology, micro RNA, construction of siRNA vectors, principle and application of gene silencing. CRISPR, CRISPR/Cas9 technology. Gene knockouts and Gene Therapy: Creation of knockout mice, suicide gene therapy,	9	Text Book 2 and Reference Book 2



gene replacement, gene targeting. Other applications: Transgenic, Genome projects and their implications, application in global gene expression analysis. Applications of recombinant DNA technology in medicine, agriculture, veterinary sciences and protein engineering.		
Case Study: In 2020 there was a viral pandemic disease that shook the entire world. Design a recombinant product that could have tackled the virus by developing immunity in individuals, in the form of an active or passive vaccine.		
Total	48	

Text book	1.	Brown, T.A. 2020, Gene Cloning and DNA Analysis: An Introduction, Wiley- Blackwell. 8th Edition. New Jersey. United States.
	2.	Bernard R. Glick, Jack J. Pasternak, Cheryl L. Patten. 2010, Molecular Biotechnology. Principles and Applications of Recombinant DNA, 4th Edition. ASM Press. University of Michigan. United States.
Reference Books	1.	Krebs, J.E., Goldstein E.S. and Kilpatrick S.T. 2018, Lewin's Gene XII, Jones & Bartlett Publishers, Boston. United States.
	2.	Primrose, S.B. and Twyman, R.M. 2016, Principles of Gene manipulation and Genomics, 8th Edition, John Wiley and Sons Ltd, Wiley-Blackwell. United Kingdom.
	3.	Thieman, W.J. and Palladino, M.A. 2019, Introduction to Biotechnology, 4th Edition, Pearson Education, Noida.
	4.	Susan, R.B. 2008, Biotechnology, Cengage Learning Pvt. Ltd., New Delhi.

Journal and Magazines	Advances in Biotechnology & Microbiology
E-Resources and Website	https://archive.nptel.ac.in/courses/102/103/102103013/#downloads

Learning Method	Chalk and Talk/ Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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Semester - II							
CORE PRACTICAL: IMMUNOLOGY AND MOLECULAR TECHNIQUES							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24MBP2CP	CORE PRACTICAL: IMMUNOLOGY AND MOLECULAR TECHNIQUES	CORE		-	72	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> the basic principles and procedures of diagnostic methods the different types of gene transfer mechanism the extraction of chicken antibodies from egg yolk.
Prerequisite	Knowledge on basic microbiological techniques

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Analysis of clinical samples for identification of pathogens	K4
CO2	Execute gene transfer techniques	K4
CO3	Able to isolate microbial genetic material	K4
CO4	Estimate the antigen and antibody concentration	K4
CO5	Appraise the process of virus cultivation from egg	K4

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓



24MBP2CP	CORE PRACTICAL : IMMUNOLOGY AND MOLECULAR TECHNIQUES	SEMESTER II
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Total Credits: 3
Total Instructions Hours: 72 h

S.No	Contents
1	Serological test for HBsAg and HBcAg
2	Antigen, Antibody detection by Dot ELISA
3	Immunodiffusion – Ouchterlony method.
4	Isolation and Identification of bacteria from clinical samples - Urine, Pus, Sputum, Stool
5	Determination of Minimal Inhibitory Concentration – Broth dilution method
6	Isolation and separation of chromosomal DNA from bacteria
7	Bacterial Transformation and Conjugation
8	Restriction Digestion of chromosomal DNA
9	Detection of Protein by Western Blotting
10	Isolation and titration of coli phages from sewage sample
11	Cultivation of animal virus by Egg inoculation – Yolk sac, Amniotic cavity Demonstration
12	Production of Chick Antibodies (IgY) – Demonstration



References

- 1 James. C. Cappuccino. 2017, Microbiology A laboratory manual, 11th edition, Pearson education publishers.
- 2 Aneja. K.R. 2012, Experiments in Microbiology, plant pathology and biotechnology, 4th Edition. New age publishers.
- 3 Rajan S. Selvi Christy. R, 2019, Experimental Procedures in Lifesciences, CBS Publishers & Distributors Pvt Ltd
- 4 Kannan, N, 1997, Laboratory Manual of General Microbiology, 1st Edition, Panima Publishing house



Semester – II CORE : BIONANOTECHNOLOGY							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24MBP2DA	BIONANOTECHNOLOGY	DSE	36	12	-	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> the role of microbes and other eukaryotes in the synthesis of nanoparticles advanced methods of characterization of nano particles educate the potential applications of nano particles/ materials in a variety of areas.
Prerequisite	Knowledge on Biological science

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Explore the basics of Nanosciences and its applications	K3
CO2	Synthesize nanoparticles at the laboratory scale.	K4
CO3	Analyze the nanoparticles by spectral and electron microscopic techniques	K4
CO4	Apply bionanomaterials in drug development and delivery.	K4
CO5	Criticize the merits and demerits of nanomaterial applications.	K4

Mapping with Program Outcomes:					
Cos/ POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓		✓	✓
CO3	✓	✓	✓	✓	
CO4	✓		✓	✓	✓
CO5		✓	✓	✓	✓



24MBP2DA	BIONANOTECHNOLOGY
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Syllabus

Unit	Content	Hrs	Resources
I	Introduction to bionanotechnology History – concept and future prospects – application in Life Sciences. Terminologies – nanotechnology, bionanotechnology, nanobiomaterials, biocompatibility, nanomedicine, nano tube, nanowires, quantum dots, nanocomposite, nanoparticles, nanosensors, nanofiber, Dendrimeter. Emergence of Bionanotechnology.	10	Text Book 1 Reference book 1
II	Synthesis of nanoparticles Synthesis - Top-down approach and bottom-up approach - Types of nanoparticles production - principle and mechanism of synthesis – physical - Sonicator, Ball mill, ablation, evaporation-condensation; chemical - reducing method - chemical reduction, irradiation, electrochemical, photoreduction; biological - microbes, plants. Green synthesis	10	Text Book 2 Reference book 1
III	Characterization of Nanoparticles Physical and chemical properties of nanoparticles. Characterization- UV-Vis spectroscopy, particle size analyzer, Electron Microscopy – HRTEM, SEM, AFM, EDS, XRD. Other tools and techniques required for bionanotechnology: X- Ray crystallography, FTIR, NMR.	10	Text Book 1 Reference book 3
IV	Applications of bionanotechnology Targeted drug delivery, biosensors and biomarkers, food and agriculture, DNA nanotech, nanoviricides, tissue engineering, gene delivery. Antibacterial activities of nanoparticles. Toxicology in nanoparticles – Dosimetry. Molecular nanotechnology – nanomachines – collagen.	9	Text Book 2 Reference book 2
V	Merits and demerits of nanoparticles Health and safety implications from nanoparticles: Health issues – Environmental issues – Need for regulation – Societal implications – Possible military applications – Potential benefits and risks for developing countries – Intellectual property issues. Bioinformatic tools in nanotechnology: molecular modeling, docking and computer assisted molecular design. Case study- Merits and demerits of any two nanoparticles in health and environment safety	9	Text Book 2 Reference book 4
	Total	48	



Text books	1.	Parthasarathy BK. 2007, Introduction to Nanotechnology, Isha Publication.
	2.	Elisabeth Papazoglou and Aravind Parthasarathy. 2007, Bionanotechnology, Morgan and Claypool Publishers, New Delhi.
Reference Books	1.	Bernd Rehm, 2006, Microbial Bionanotechnology: Biological Self-assembly Systems and Biopolymer-based Nanostructures. Horizon Scientific Press.
	2.	David E Reisner and Joseph D Bronzino, 2008, Bionanotechnology: Global Prospects. CRC Press, New Delhi.
	3.	Ehud Gazit, 2006, Plenty of Room for Biology at the Bottom: An Introduction to Bionanotechnology. Imperial College Press.
	4.	Kamali Kannangara, 2005, Nanotechnology: Basic science and Emerging technologies- Mick Wilson, Overseas Press.

Journal and Magazines	https://jnanobiotechnology.biomedcentral.com https://nanomagazine.com
E-Resources and Website	https://archive.nptel.ac.in/courses/118/107/118107015 https://www.coursera.org/learn/nanotechnology

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations



SEMESTER II
DSE: BIOCHEMISTRY OF TOXICOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
II	24BCP2DA	BIOCHEMISTRY OF TOXICOLOGY	DSE	36	12	-	3

Preamble	<p>This course has been designed for students to learn and understand</p> <p>The biochemical basis of toxicology</p> <p>The effects and metabolism of toxins</p> <p>General toxicology, methods of toxicity testing, toxins from microbes, carcinogenic & teratogenic toxins, pesticide, metal and chemical toxicology</p>
Prerequisite	Basic knowledge about Toxicity

Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Explain the importance of toxicology	K2
CO2	Distinguish and evaluate the biochemical effects of toxic agents on cellular macromolecules and tissues	K4
CO3	Compare the different genetic methods used for testing toxicity	K4
CO4	Analyze the effects and metabolism of various microbial toxins, teratogens and carcinogens	K4
CO5	Assess the mode of action of toxic pesticides, heavy metals, chemicals and air pollutants	K5

Mapping with Program Outcomes:					
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓



24BCP2DA	BIOCHEMISTRY OF TOXICOLOGY
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Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Introduction to Toxicology Definition and scope of toxicology, Classification of toxic agents. Dose-response relationship: Synergism and Antagonism, Determination of ED50 and LD50. Acute and chronic exposures, Factors influencing toxicity - Abiotic and Biotic factors, Chemical interactions - Bioaccumulation and Bio-magnification	9	Text Book, Reference book and E-Resources
II	Biochemical basis of Toxicology Toxicokinetics-ADME (Absorption, Distribution, Metabolism and Excretion) and Toxicodynamics. Mechanisms of Toxicity, Interaction of toxicant with target molecules - Disturbance of excitable membrane function. Altered calcium homeostasis. Blood brain barrier penetration. Organ Toxicology, Genetic and reproductive toxicology, Toxicogenomics.	9	Text Book and Reference Book
III	Principles and procedures of testing for acute toxic effects Toxicity testing - In-vitro test systems - Bacterial mutation tests: Fluctuation tests, Ames test, Eukaryotic mutation test: Micronucleus Test, Comet Assay, Chromosomal Aberration Test. In-vivo mammalian mutation tests - Host mediated assay and Dominant lethal test. Use of drosophila in toxicity testing. Toxicity testing in animals. Toxicological evaluation of Recombinant DNA-derived proteins.	10	Text book, Reference book, E-Resources and YouTube Videos
IV	Effects and Metabolism of toxins Fungal toxins, Mycotoxins - Aflatoxins, Bacterial toxins - Exotoxins and Endotoxins, Viral toxins, Algal toxins, Teratogens, Carcinogens, Mutagens, Snake venom toxin, Spider, Scorpion and Jellyfish toxins, Antivenom. Xenobiotic metabolism: Phase I- III reactions, Cytochrome-P450. Free radical theory of oxygen toxicity.	10	Text book, NPTEL, and E-resources
V	Pesticide toxicology, Metal toxicology, Chemical toxicology, Air and water pollutants Mechanism and site of action of Chlorinated organics (DDT, BHC), organophosphates and carbamates. Fungicides, Herbicides. Environmental consequences of pesticide toxicity. Biopesticides, Mode of action of toxic heavy metals - arsenic, mercury, cadmium and lead. Biochemical effects of	10	Text book, NPTEL and Reference book



	ozone, peroxyacetyl nitrate (PAN), carbon monoxide, nitrogen oxides, sulphur dioxide and cyanide. Drug induced toxicity-example- Paracetamol. Common air pollutants, water pollutants and their sources, air pollution due to methyl-isocyanate (MIC) and asbestos. Toxicology of food additives, Case studies.		
	Total	48	

Text Book	1.	<i>Klaassen Curtis, D., 2019, "Casarett and Doull's Toxicology - The basic Science of Poisons", 9th edition, McGraw Hill Education, London.</i>
	2.	<i>Cockerham, L.G. and Shane, B.S., 2019, "Basic Environmental Toxicology", 1st edition, CRC Press, New York</i>
Reference Books	1.	<i>Robert, S.M. and James, R.C., 2015, "Principles of Toxicology: Environmental and Industrial Applications", 3rd Edition, John Wiley and Sons, New York.</i>
	2.	<i>De, A.K., 2017, "Environmental Chemistry", 8th Edition, Newage International Publishers, New Delhi..</i>
	3.	<i>Gupta, P.K., 2016, "Fundamentals of Toxicology - Essential concepts and Applications", 1st edition, Academic Press, Cambridge, USA.</i>
	4.	<i>Gupta, R., 2019, "Biomarkers in Toxicology", 2nd Edition, Academic Press, Cambridge, USA.</i>

Journal and Magazines	https://www.sciencedirect.com/science/article/abs/pii/S014181302100354 https://www.europeanreview.org/wp/wp-content/uploads/1633-1653.pdf https://pmc.ncbi.nlm.nih.gov/articles/PMC10247286/ https://www.tandfonline.com/doi/full/10.1080/17435390.2020.1815886
E-Resources and Website	https://onlinecourses.swayam2.ac.in/ini24_bt04/ [NPTEL] https://byjus.com/biology/difference-between-biomagnification-and-bioaccumulation/

Learning Methods	Chalk and Talk/ Video tutorials/PPT/ GD/ Assignment/ Seminar
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Focus of the Course	Skill Development/Employability/Entrepreneurial development/Innovations
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Semester – II DSE: FORENSIC BIOTECHNOLOGY							
Semester	Course Code	Course Name	Category	L	T	P	Credits
II	24BTP2DA	FORENSIC BIOTECHNOLOGY	DSE	36	12	-	3

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none">• Basics and fundamentals of the sample collection and examination in forensic aspects• Different types of DNA profiling and DNA databases used in Forensic analysis• Applications of Forensic Biotechnology in various fields	
Prerequisite	Knowledge on techniques and applications of forensic Biotechnology	
Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Infer the sample collection for forensic examinations	K3
CO2	Know the methods to characterize the different samples on forensic prospective	K3
CO3	Interpret and examine forensic evidence by DNA profiling methods	K3
CO4	Analyze and interpret the forensic DNA Statistics and Database	K4
CO5	Conclude the significance and applications of Forensic Biotechnology	K5

Mapping with Program Outcomes					
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓		✓	✓



24BTP2DA	FORENSIC BIOTECHNOLOGY
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Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Forensic science - History, scope, branches and functions. Forensic science in international perspectives- INTERPOL and FBI. Duties of forensic scientists. Forensic laboratories in India and worldwide. Collection and Preservation of biological samples-Blood, Semen, Saliva, Vomit, Hair, Fibers, Urine and Fecal matter from crime scene.	08	https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000016FS/P000699/ M011531/ET/1516257285FSC_P12_M5_e-text.pdf
II	Importance of Hair, Sperm and Blood in forensic characterization. Hair- morphology, tests for their identification. Blood- composition and properties, presumptive and confirmatory tests. Sperm-composition, morphology of spermatozoa, presumptive and confirmatory tests (including Azoospermic semen stains), seminal fluid isozymes typing.	10	1516257136FSC_P12_M2_e-text.pdf
III	Structure of DNA, DNA extraction-organic and inorganic extraction. Variations in DNA related to forensic Biotechnology, DNA profiling-history and applications. Methods used in DNA profiling-Restriction Fragment Length Polymorphism (RFLP), Polymerase Chain Reaction (PCR), RAPD, Short Tandem Repeat (STR) Analysis, Single Nucleotide Polymorphism (SNP) Analysis, Mitochondrial DNA (mtDNA) Profiling, Y-Chromosome STR (Y-STR) Analysis and Variable Number Tandem Repeats (VNTR) Analysis.	10	https://www.frontiersin.org/journals/ecology-and-evolution/articles/10.3389/fevo.2021.646130/full
IV	DNA Statistics- allele frequency, Random Match Probability (RMP), Paternity/Maternity index, Sibling index. Impact of Human genome project on Forensic Biotechnology. DNA forensic databases; Ethical, legal, and social issues associated with DNA data banking, potential benefits of DNA data banking, quality control, certification and accreditation.	10	https://wbja.nic.in/wbja_adm/files/dna%20profilin g%20%20cfl.pdf
V	Forensic Biotechnology Applications –Criminal investigations, Disputed paternity cases, Child swapping, Disaster Victim Identification (DVI), Civil immigration, Veterinary, Wildlife,	10	https://www.walshmedic almedia.com/open-access/application-of-dna-fingerprinting-in-an-



	Environment, Public Health and Epidemiology, Agriculture and Food safety. New and Future technologies for Forensic Biotechnology.		alleged-case-of-paternity-2161-1009-1000165.pdf
	Total	48	

Text Book	1.	Richard Saferstein E, 2020, "Forensic Science Handbook", 2 nd Edition, Prentice Hall, New Delhi.
Reference Books	1.	William Tilstone J, Kathleen Savage A and Leigh Clark A, 2006, "Forensic Science: An Encyclopedia of History, Methods and Techniques", 1 st Edition, ABC – CLINO Inc, California.
	2.	Allan Jamieson and Scott Bader, 2016, "A Guide to Forensic DNA Profiling", 10 th Edition, John Wiley & Sons, UK.
	3.	John Butler M, 2005, "Forensic DNA Typing - Biology, Technology, and Genetics of STR Markers", 2 nd Edition, Academic Press, United States.
	4.	John Butler M, 2009, "Fundamentals of Forensic DNA Typing", 1 st Edition, Academic Press, United States.

Journal and Magazines	Singh, Harendra Nath. (2021). Collection, Preservation and Transportation of Biological Evidence Forensic DNA Analysis. 9. 1123-1130.
E-Resources and Website	https://pmc.ncbi.nlm.nih.gov/articles/PMC3168143/ https://www.sciepublish.com/article/pii/279 https://blog.bccresearch.com/technology-trends-shaping-the-future-of-forensics-industry

Learning Methods	Learning Management System, PPT, Flipped Classroom
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Focus of the Course	Skill Development/Employability/Entrepreneurial Development
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[Signature]
 BoS Chairman/HOD
 Department of Microbiology
 Dr. N. G. P. Arts and Science College
 Coimbatore - 641 048

Dr.N.G.P. Arts and Science College		
APPROVED		
BoS- 18th 08/11/2024	AC - 18th 26/11/2024	GB -



Dr.NGPASC

COIMBATORE | INDIA

M.Sc. Microbiology (Students admitted during the AY 2024-25)

Semester – III							
CORE XI: ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY							
Semester	Course Code	Course Name	Category	L	T	P	Credits
III	24MBP3CA	ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY	CORE	48	-	-	4

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> the diversity of microorganisms in different milieu.] [the beneficial role of microbes in the process of recycling different molecules with the aid of biogeochemical cycles. [explore the positive utilities of microorganisms in agriculture.]
Prerequisite	Basic Knowledge on environment

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Validate the microorganisms of air	K3
CO2	Comprehend the different biogeochemical cycles	K3
CO3	Utilize microorganisms in agriculture	K3
CO4	Analyze the quality of water sample	K3
CO5	Utilize microorganisms efficiently in removing wastes	K4

Mapping with Program Outcomes:					
Cos/ POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓	✓	
CO2	✓		✓	✓	
CO3	✓	✓	✓	✓	✓
CO4	✓		✓		
CO5	✓	✓	✓	✓	✓

24MBP3CA	ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY
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Syllabus

Unit	Content	Hrs	Resources
I	Aerobiology] [Microbial flora of air - Biological indicators of air pollution. Enumeration of microorganisms from air - Air sampling devices. Significance of air Micro flora, Airborne diseases - Bacterial, Fungal and Viral. Effect of Air pollution on plants and Humans. Air sanitation - Dilution, UV light, HEPA filters, fumigation, desiccant rotor.	9	Text Book
II	Soil Microbiology Structure, Types, Physical and Chemical properties - Soil microbes - Isolation, types of organisms and its enumeration - Weathering and Humus formation - Soil pollution - Sources. Biogeochemical cycling - Nitrogen, Carbon, Phosphorous, Sulphur and Iron cycles its significance.	9	Text Book
III	Microbes in Agriculture Nitrogen Fixing Microorganisms - Symbiotic and free - living nitrogen fixers - Rhizobium, Azotobacter, Azospirillum, Frankia, BGA and Azolla - Phosphate solubilizers - Phosphobacterium and Aspergillus. Phytopathogens - Bacterial, Fungal and Viral diseases - Wilt, Blight, Canker, Mosaic, Wildfire, Crown gall, Soft rot - Control measures.	10	Text Book
IV	Aquatic Microbiology Microbiology of water - Fresh water and Marine - Water Pollution and Waterborne Pathogens - Assessment of water quality - Chemical and Microbial - Bacteriological examination of water - MPN, Coliform count - Indicator organisms - Microbiology of Sewage - Waste water treatment - primary, secondary and tertiary - Biological oxygen demand (BOD) and Chemical oxygen demand (COD).	10	Text Book
V	Waste Management Recycling of Solid wastes - landfills, vermicomposting - Value added products from wastes - Biogas, Mushroom and SCP production. Biodegradation of Complex Polymers - Cellulose, Hemicellulose, Lignin, Chitin and Pectin, Bioremediation - In- situ, Ex -situ, Intrinsic and Engineered, Bioleaching - Copper and Uranium. Artificial Intelligence applications in pollution control Case Study: Consider that due to induced mutation most of the bacteria present on the surface of our earth are killed. Which biogeochemical cycle is this condition capable of altering tremendously and why? What could be the after effect of such a condition?	10	Text Book

	The Chennai Coast faces periodic oil spills due to the activities of shipping vessels and industrial operations near the coast. The spills negatively impact the marine life, including fish stocks and coastal ecosystems. How this can be treated through bioremediation ?		
	Total	48	

Note: Case studies related to the above topics to be discussed (Examined Internal only)

Text book	1.	Atlas R. M and Bartha, (2005). Marketing Management. (5th Edn.) Delhi:Prentice Hall.
	2.	Black J. G. (2013). Microbiology. (8 Edn.) New Delhi:John Wiley and Sons.
Reference Books	1.	Michael Madigan, (2015). Brock Biology of Microorganisms. (15 Edn.) New Delhi:Pearson publishers.
	2.	Maier RM, Pepper IL and Gerba CP,. (2009). Environmental Microbiology. (2 Edn.) New Delhi:Academic Press.
	3.	Joseph C Daniel, (1999). Environmental Aspects of Microbiology. (1Edn.) Chennai: Bright Sun publishers.
	4.	Alexander,M. (1977). Introduction to soil microbiology. (2 Edn.) John Wiley & Sons, Inc., New York.
	5.	[Madigan, M., Bender K. S., Buckley D.H., Sattley W. M., and Stahl D.A. Brock. (2017) . Biology of Microorganisms. (15th ed) Pearson Publishers, New York.]
	6.	[NPTEL Course - Applied Environmental Microbiology: https://nptel.ac.in/courses/105107173]

Journal and Magazines	Environmental microbiology -Wiley online library <i>Applied and Environmental Microbiology</i>
E-Resources and Website	NPTEL Course on Applied environmental microbiology www.environmentshumail.blogspot.in , https://www.frontiersin.org/articles/10.3389/fpls.2017.01617/full

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development /Social Awareness/ Environment
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Semester - III							
CORE I: MEDICAL MYCOLOGY AND PARASITOLOGY							
Semester	Course Code	Course Name	Category	L	T	P	Credits
III	24MBP3CB	MEDICAL MYCOLOGY AND PARASITOLOGY	CORE	48	-	-	4

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> • The concept of infectious disease process, transport, processing and examination of medically important fungi • The concept of infectious disease process, transport, processing and examination of medically important parasite • Helminthic infections and emerging parasitic infections.
Prerequisite	Knowledge on Fungi and Parasites

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Recognize the importance of infectious disease and processing of clinical samples.	K3
CO2	Classify the morphology, cultural characteristics and pathogenesis of fungal infections.	K3
CO3	Illustrate the morphology, cultural characteristics and pathogenesis of subcutaneous mycosis.	K3
CO4	Adapt suitable technique to identify the blood borne parasitic infections.	K3
CO5	Apply the techniques for identification of helminthic parasitic infections.	K3

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓		
CO5	✓	✓	✓		✓

24MBP3CB	MEDICAL MYCOLOGY AND PARASITOLOGY
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Syllabus

Unit	Content	Hrs	Resources
I	Over View of Fungi Infection Morphology, Taxonomy, Classification of medically important Fungi (Morphology, Infection & Reproduction), Immunity to Fungal Infections. Culture Media and Stains in Mycology, Normal fungal flora of human beings, Specimen collection, preservation, Transportation & Identification of Mycological Agent. Prevention and Control of Mycotic and Parasitic Infections.	10	Text Book1
II	Dermatophytes Dermatophytes and causative agents of superficial mycoses - Trichophyton. Edidermophyton and Microsporum. Yeasts of medical importance - Candida, Cryptococcus. Pityriasis versicolor, White piedra, Black piedra, Tinea nigra and Mycotoxins. Allergic Fungal diseases - Mycetismus. Epidemiological trends and outbreaks.	10	Text Book1&2
III	Subcutaneous and Other Mycosis Subcutaneous Mycosis - Mycetoma, Sporotrichosis, Chromoblastomycosis, Systemic Mycosis- Histoplasmosis, Blastomycosis, Coccidioidomycosis, Black fungus. Opportunistic Mycosis - Candidiasis, Aspergillosis, Miscellaneous Mycosis- Otomycosis. Fungal infections in eyes. New antifungal drugs and vaccines	10	Text Book1 & 2 Ref book 1
IV	Introduction and Classification of Parasites Introduction and classification of parasites - Pathogenesis, life cycle, lab diagnosis and prognosis of blood parasites - Malaria, and Filariasis - Intestinal amoebae. Examination of faeces, Direct and concentration methods. Antiparasitic Drugs.	9	Ref book 3 & 4
V	Helminthic Infections Helminthic Infections - <i>Taenia solium</i> , <i>T. Saginata</i> , <i>Echinococcus granulosus</i> , <i>Fasciola hepatica</i> , <i>Paragonimus westermani</i> and <i>Schistosomes</i> , <i>Ascaris lumbricoids</i> , <i>Ancylostoma duodenale</i> , <i>Trichuris triuchura</i> and <i>Enterobius vermicularis</i> . Blood smear examination - Serology and Molecular Diagnosis- Emerging parasitic infections. Antihelmintic drugs. Case Study: A 60 year old male admitted to the hospital complaining of shortness of breath, fever, chest pain and cough with blood. His medical history indicates he has smoked one pack of cigarette per day for past 40 years. Recently, he has been on immunosuppressive therapy for severe arthritis. A biopsy specimen of lung is obtained, a back	9	Ref book 3 & 4

	colony growth observed on agar plate. Could you find the causative agent with further diagnosis? And suggest some drugs.)		
	Total	48	

Note: Case studies related to the above topics to be discussed (Examined Internal only)

Text book	1.	Chander J. 2017, "Text Book of Medical Mycology", 4th Edition. Jaypee Brothers Medical Pub. New Delhi.
	2.	Errol Reiss, H. Jean Shadomy, G. Marshall Lyon, 2016, "Fundamental Medical Mycology", Wiley-Blackwell. Unites States.
Reference Books	1.	Reiss E. Shadomy H.J. and Lyon G.M, 2011, "Fundamental Medical Mycology", Wiley-Blackwell. Unites States.
	2.	Brooks G., Carrol K.C., Butel J. and Morse S, 2012, "Jawetz Melnick and Adelberg Medical Microbiology", 26th Edition. Lange Medical Publications USA.
	3.	Chatterjee K.D, 2019, "Parasitology: Protozoology and Helminthology", 13th Edition. CBS Publishers & Distributors Pvt. Limited. New Delhi.
	4.	Arora DR, 2020, "Medical Parasitology",. 5th Edition. CBS Publishers & Distributors Pvt. Limited. New Delhi.

Journal and Magazines	https://academic.oup.com/mmy?utm_source=chatgpt.com&login=false
E-Resources and Website	https://www.cdc.gov/parasites/index.html , https://www.who.int/news-room/fact-sheets/detail/neglected-tropical-diseases , https://asm.org/

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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Semester – III							
CORE III: PHARMACEUTICAL MICROBIOLOGY AND QUALITY ASSURANCE							
Semester	Course Code	Course Name	Category	L	T	P	Credits
III	24MBP3CC	PHARMACEUTICAL MICROBIOLOGY AND QUALITY ASSURANCE	CORE	48	-	-	4

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> • the Quality and Sterility methods in pharmaceutical products the managerial actions of planning, organizing and motivation • the role of a microbiologist in Pharma Industry. • standardization of protocols in quality assurance of pharmaceutical products
Prerequisite	Knowledge on Pharmaceutical Microbiology

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the sampling guidelines for quality control..	K3
CO2	Apply GMP in pharmaceutical industry.	K3
CO3	Interpret the test in accordance with pharmacopoeia compendia standards.	K3
CO4	Analyze the significance of quality assurance in a pharmaceutical industrial process..	K3
CO5	Adopt the regulatory compliance in pharma industry.	K3

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓		
CO5	✓	✓	✓		✓

24MBP3CC	PHARMACEUTICAL MICROBIOLOGY AND QUALITY ASSURANCE
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Syllabus

Unit	Content	Hrs	Resources
I	Overview on practices and sampling WHO good manufacturing practices: Quality management in the drug industry: Heating, Ventilation and air conditioning systems of sterile and non-sterile pharmaceutical firms - Quality assurance - sampling and its types -raw materials, water, containers, condensates, polythene bags and air.	9	Text Book
II	Spoilage and Quality analysis Types of spoilage- Physical, chemical and biological - Factors affecting spoilage - assessment of microbial spoilage - Selection and use of cleaning and disinfection agents in pharmaceutical manufacturing - Environmental monitoring methods in sterile and non sterile area -Sterilization control - sterilization monitors and Quality assurance of products Microbial Spoilage Mechanisms in Pharmaceuticals.	9	Text Book
III	Testing methods and Regulations Sterile and non sterile pharmaceutical products and their testing protocols: Sterility test - Microbial Limit Test - Bacterial endotoxin test (LAL test). Microbiological quality and regulatory requirements for WHO and FDA - Containment system integrity - Veterinary antimicrobial products - Bio therapeutics and manufactured products.	10	Text Book
IV	Quality assurance in pharmaceutical industry The role of the qualified person in microbiological quality assurance - Safety in microbiology - Rapid enumeration and identification methods - Measurement of biocide effectiveness - International disinfectant testing protocols. Clean-in-Place, Sterilization in- place, clean room design, operation and regulatory standards.	10	Text Book
V	Validation in quality assurance Microbiological quality assurance - Validation and types. Validation of aseptic processing and media fill piggy back analysis- Internal and Regulatory Auditing of the pharmaceutical microbiology department. Continuous Process Verification (CPV) and Real-Time Monitoring. Report writing and Documentation in microbiology lab. Case study: Examine the changes in the environmental parameters in around the pharmaceutical industry such as N ₂ , CO ₂ , SO ₂ and microbial flora	10	Text Book
Total		48	

Note: Case studies related to the above topics to be discussed (Examined Internal only)

Text book	1.	W.B.Hugo&A.D.Russel (2007). Pharmaceutical Microbiology. (4Edn.) New Delhi: Blackwell Scientific Publications
	2.	Philip Kotler, R (2014). Quality assurance of pharmaceuticals A compendium of guidelines and related materials Volume 2. (2 updated Edn.) Delhi: Prentice Hall
Reference Books	1.	Madigan ,M. (2006). Brock Biology of Microorganisms. (11 Edn.) USA: Pearson-Prentice Hall.
	2.	Dr Norman Hodges and Professor Geoff Hanlon (2012).Essential Microbiology for Pharmacy and Pharmaceutical Science. (1 Edn.) Wiley Blackwell
	3.	Geoff Hanlon and Tim Sandle, (2015). Industrial Pharmaceutical Microbiology - Vol&VolII: standards & Controls.(5Edn.):Euromed Communications..

Journal and Magazines	Journal of Medicine and Pharmacy Research
E-Resources and Website	www.pdfdrive.net.in

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Development	Employability/	Entrepreneurial
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Semester – III							
CORE : FOOD MICROBIOLOGY AND FOOD QUALITY CONTROL							
Semester	Course Code	Course Name	Category	L	T	P	Credits
III	24MBP3CD	FOOD MICROBIOLOGY AND FOOD QUALITY CONTROL	CORE	48	-	-	4

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> • The relation between food and microbes. • The significance of fermented foods, food borne diseases and food quality control • The importance of food laws and regulations.
Prerequisite	Knowledge on Food Microbiology and Quality Control

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the physiological conditions of microbes in food.	K3
CO2	Summarize the importance of food borne diseases.	K3
CO3	Apply suitable microbiological techniques for identification of food borne microorganisms.	K3
CO4	Adopt various quality assurance methods in food industry.	K3
CO5	Understand the food laws and regulations.	K3

Mapping with Program Outcomes:					
Cos/ POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓			✓
CO2	✓	✓		✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5		✓		✓	✓

24MBP3CD	FOOD MICROBIOLOGY AND FOOD QUALITY CONTROL
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Syllabus

Unit	Content	Hrs	Resources
I	Food as a substrate Incidence and types of microorganisms in food - Contamination and Spoilage of Meat, Poultry, Sea foods, Vegetables, Fruits. Principles of food preservations: Asepsis, Preservation by use of High temperature, Low temperature, Canning, Drying, Radiation and Food additives.	12	Text Book 1
II	Fermented foods and food borne diseases Fermented foods - pickles - sauerkraut - Meat and fishery products - Country cured hams, Dry sausages, Katsubushi. Fermented milk products -, Yoghurt and Cheese. Food poisoning - Food borne diseases- Bacterial and Non- Bacterial. Case Study: A local community health report in Tamil Nadu documented repeated cases of mild food poisoning linked to improperly stored fermented rice batter, used for idli/dosa. The spoilage was linked to warm storage conditions and microbial imbalance, leading to pathogenic growth. Discuss how the Artificial Intelligence (AI) and Indian Knowledge Systems (IKS) can be synergistically applied to ensure microbial safety in traditional fermented foods.	9	Text Book 1 and 2
III	Microbial analysis of food Indicator organisms - Direct examination - culture techniques - enumeration methods - plate - Viable & Total Count; Alternative methods - Dye reduction tests , electrical methods , ATP determination: Rapid methods, immunological methods - DNA / RNA methodology - Laboratory accreditation.	10	Text Book 2
IV	Quality assurance in food industry In house Committee for quality assurance, Persons involved, Internal Microbial Quality control Policy, Quality Check at every step from collection of raw materials till it reaches the customer, GMP, SSOP, HACCP- Principles & Applications.	8	Text Book 2
V	Food laws and regulations National - PFA Essential Commodities Act (FPO, MPO etc.). International - Codex Alimentarius, ISO - 9000 series, ISO 22000 & BS 5750. Regulatory Agencies - WTO, FSSAI. Hygiene and sanitation in food sector General Principles of Food Hygiene, GHP for commodities, equipment, work area and personnel, cleaning and disinfection (Methods and agents commonly used in the hospitality industry), Safety aspects of processing water (uses & standards) and Waste Water & Waste disposal.	9	Text Book 1 and 2
Total		48	

Note: Case studies related to the above topics to be discussed (Examined Internal only)

Text book	1.	Frazier. W.C and D.C Westhoff, (2008). Food Microbiology. (5th Edn.) Delhi: McGraw Hill publishing Co.,
	2.	Jay, J. M. (2007). Modern Food Microbiology. (7Edn.) New York: Van.
Reference Books	1.	Adams. M. R and M. D Moss,. (2008). Food Microbiology. (3 Edn.) New Delhi: Panama Publishers.
	2.	D Kumar Bhatt, Priyanka Tomar,. (2010). An Introduction to Food Science Technology and Quality Management. (Edn.) New Delhi: Kalyani Publishers.

Journal and Magazines	Food Microbiology Journal ScienceDirect.com by Elsevier , Journal of Food Quality - Wiley Online Library
E-Resources and Website	Free Online Food Safety Courses Alison , Food FDA

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Intellectual Property Rights/ Entrepreneurial Development/ Innovations
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Semester - III							
CORE V: RESEARCH METHODOLOGY AND BIOSTATISTICS							
Semester	Course Code	Course Name	Category	L	T	P	Credits
III	24MBP3CE	RESEARCH METHODOLOGY AND BIOSTATISTICS	CORE	36	12	-	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> • The range of research methods the managerial actions of planning, organizing and motivation • The basis of statistical methods and their usage. • The importance of statistical methods in biological sciences
Prerequisite	Knowledge on Research skills

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Categorize and design a research study and recognize the process and analysis of research data	K3
CO2	Interpret the reports for statistical and qualitative data. Demonstrate competence in open defense presentation.	K4
CO3	Write the research article and extramural proposals	K3
CO4	Acquire the knowledge on basic concepts of biostatistics	K4
CO5	Understand and compute the basic descriptive statistical measures.	K4

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓	✓	✓
CO2	✓	✓	✓	✓	
CO3	✓	✓		✓	✓
CO4	✓	✓	✓	✓	
CO5		✓	✓	✓	✓

24MBP3CE	RESEARCH METHODOLOGY AND BIOSTATISTICS
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Syllabus

Unit	Content	Hrs	Resources
I	Research Methodology: An Introduction Research Methodology - Definition, objectives and types of research. Research approaches - Processing and analysis of research data - Identification of research gap - Research design. Sampling - types and design.	9	Text Book
II	Thesis Preparation and presentation Components of thesis - Title - Acknowledgements - Abstract - Keywords - Introduction - Materials and Methods - Results - Discussion - Summary - Bibliography and its types. Preparation for Open Defense Presentation.	9	Text Book
III	Article and Research proposal preparation Article Writing: Article collection - Mendeley reference manager tool - Components of Research article, Review article. Book and book chapters - Research proposal writing - Developing an outline Preamble - specific aim - background structure - budget proposal and justification. Plagiarism. Funding agencies in India and their operations - GOs and NGOs.	10	Text Book
IV	Introduction to Biostatistics Definition - Scope of Biostatistics. Applications of biostatistics. Specific aspects of statistical data - Collection and Classification of data. Methods of representation of statistical data - Graphical, Pictorial and tabular - essential features, types, significance and limitations	10	Reference Book
V	Descriptive statistics Measures of central tendency - Arithmetic mean, Median, Mode. Calculation of Mean, median, Mode in series of individual observations, discrete series, continuous. Measures of dispersion - standard deviation. Correlation - Karl pearsons coefficient of correlation - Analysis in SPSS software. Case Study: Point out the difference between one tailed and two tailed tests and how can you test the significance between two mean under large sample?	10	Reference Book
	Total	48	

Note: Case studies related to the above topics to be discussed (Examined Internal only)

Text book	1.	Gupta, S. P., (2009). Specifications of Statistical methods, 28th Edition. Sultan Chand & sons.
	2.	Kothari, C. R., (2004). Research Methodology: Methods and Techniques, New Age International, New Delhi.
Reference Books	1.	Zar, J.H. (2006). Biostatistical analysis, 4th Edn. Pearson education Inc. New Jersey.
	2.	Sundar Rao, P.S.S. and Richard, J. (2006). Introduction to Biostatistics & Research methods. Prentice -Hall of India (P) Ltd, New Delhi.
	3.	R S N Pillai and Bhagavathi, S. (2003). Practical Statistics. 4th Edn. Chand Publisher
	4.	D. N. Elhance, Veena Elhance and B. M. Aggarwa. (2010). Fundamentals of Statistics First Edition, Kitab Mahal Publisher.
	5	https://onlinecourses.nptel.ac.in/noc20_bt28/preview
	6	https://onlinecourses.swayam2.ac.in/cec20_mg13/preview
	7	https://onlinecourses.swayam2.ac.in/cec20_bt23/preview

Journal and Magazines	<u>Principles Of Management Academy of Management Journal (aom.org)</u>
E-Resources and Website	<u>Infosys Springboard: Digital Learning and Reskilling Programs</u> <u>Principles of Management Coursera</u>

Learning Method	Chalk and Talk/ Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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Semester – III							
CORE PRACTICAL: APPLIED MICROBIOLOGICAL TECHNIQUES							
Semester	Course Code	Course Name	Category	L	T	P	Credits
III	24MBP3CP	APPLIED MICROBIOLOGICAL TECHNIQUES	CORE		-	72	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> Fundamental microbiological techniques applied in clinical, environmental, food, and pharmaceutical microbiology. The microbial presence, assess contamination, and evaluate antimicrobial or preservative effectiveness. Core laboratory skills and analytical thinking in microbial identification, control, and detection methods.
Prerequisite	Skill development on Industrial applications

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Apply standard microbiological techniques to isolate and identify microorganisms from various environments.	K5
CO2	Evaluate the effectiveness of antimicrobial agents and preservatives using appropriate assays.	K3
CO3	Perform quality control tests on pharmaceutical and food products to ensure microbial safety.	K4
CO4	Demonstrate the use of molecular tools like Real-Time PCR for rapid pathogen detection.	K3
CO5	Analyze the role of beneficial microbes in environmental sustainability and bioremediation.	K3

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓		✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

24MBP3CP	APPLIED MICROBIOLOGICAL TECHNIQUES
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S.No	Contents
1	Assessment of Airborne Microflora in Different Environments - Settle plate technique
2	Decolorization of Industrial Dyes by Microorganisms for Environmental Bioremediation
3	Isolation of Nitrogen-Fixing Bacteria (e.g., <i>Rhizobium</i> , <i>Azotobacter</i>)
4	Germ Tube Test for rapid identification of <i>Candida albicans</i>
5	Antifungal Susceptibility Testing by disc diffusion assay
6	Stool Examination for Intestinal Parasites by direct wet mount
7	Sterility Testing of ophthalmic Products using membrane filtration method
8	Quality analysis of non-sterile pharmaceuticals - Microbial Limit test
9	Preservative Efficacy Testing (PET) of Pharmaceutical Products
10	Shelf-life study of packaged food product during different storage conditions
11	Quality analysis of milk sample - Resazurin test
12	Rapid detection of pathogenic microorganisms using Real Time PCR - Demonstration

References	1.	Aneja K R, 2012, "Experiments in Microbiology, plant pathology and biotechnology", 4th Edition. New age publishers, Kolkata.
	2.	James C Cappuccino, 2013, "Microbiology A laboratory manual", 1st edition, Pearson education publishers, Bangaluru.

Learning Method	Demonstration/ Hands on Experiments
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Focus of the Course	Skill Development/ Employability
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Semester - III DSE - III: MEDICAL LABORATORY TECHNIQUES							
Semester	Course Code	Course Name	Category	L	T	P	Credits
III	24MBP3DA	MEDICAL LABORATORY TECHNIQUES	DSE	36	12	-	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> • The organization of clinical laboratory • The processing of clinical samples • The importance of SOP in laboratory testing
Prerequisite	Basic knowledge on biological sciences, biochemistry, microbiology, or health sciences

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the Principles and Organization of Clinical Laboratories	K3
CO2	Explain the Use of Antiseptics, Disinfectants, and Antibiotics	K3
CO3	Perform Blood Collection, Processing, and Analysis	K3
CO4	Process and Analyze Urine, Stool, and Sputum Samples	K3
CO5	Manage Laboratory Equipment, Certification, and Waste Disposal	K3

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		✓
CO2		✓	✓	✓	✓
CO3	✓	✓		✓	✓
CO4	✓	✓			
CO5	✓	✓			✓

24MBP3DA	DSE - MEDICAL LABORATORY TECHNIQUES
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Syllabus

Unit	Content	Hrs	Resources
I	<p>Introduction to Clinical laboratory</p> <p>Basic laboratory principles - Organization of clinical laboratory - Biosafety in containment laboratory - National and International GLP (Good laboratory Practices) - Role of medical laboratory technician - personnel hygiene and safety measures.</p> <p>Case study: A containment lab worker reports symptoms of infection after handling high-risk patient samples. How can risk assessments help in preventing such incidents?</p>	9	Text Book
II	<p>Antiseptics & Disinfectants</p> <p>Definition -Types - Mode of Action - Uses. Antimicrobial agents and Antibiotics: Introduction, mechanism of action, classification and uses, Antibiotic susceptibility testing - Stokes, Kirby-Bauer method, Minimal Inhibitory Concentration and Minimal Bactericidal Concentration.</p> <p>Case study: A lab technician is asked to disinfect a surface contaminated with blood samples. What type of disinfectant should be used?</p>	9	Text Book
III	<p>Collection and processing of blood</p> <p>separation of serum and plasma - Sampling errors - Preservation of samples. Determination of Total Count, Differential Count, Erythrocyte Sedimentation Rate, Hemoglobin concentration (Hb), Bleeding Time & Clotting Time. ABO Blood group system. Detection of blood glucose, Urea, Cholesterol and Bilirubin. Profiling - Liver function test, Renal function tests.</p> <p>Case study: A blood sample for an ESR test is rejected because of incorrect tube selection. What type of tube is required for ESR testing?</p>	10	Text Book
IV	<p>Processing of Urine, Stool and Sputum sample</p> <p>Collection, transport and Storage of Urine, Stool and Sputum sample. Macroscopic and Microscopic examination - Urine: sugar, albumin, bile salts, bile pigments and ketone bodies - Pregnancy Test. Stool - Cyst, Ova, Mucus, Pus, RBC, Reduced sugar, Occult blood. Sputum -Petroff's method, AFB staining.</p> <p>Case study: A stool test report indicates the presence of RBCs, pus cells, and mucus. What possible infections or</p>	10	Text Book

	conditions can cause these findings?		
V	<p>Maintenance of Laboratory Equipment - Centrifuge, calorimeter, microscope, incubator, autoclave. Laboratory Certification process - National Accreditation Board for Laboratories, Indian Standard Organization - Standard Operating Procedure - Clinical Laboratory records. Biomedical waste management - Bureau of Indian Standards- danger signs and Symbols.</p> <p>Case study: A laboratory applies for certification under the NABL but fails the initial inspection. What common factors could lead to a failed NABL certification audit?</p>	10	Text Book
	Total	48	

Note: Case studies related to the above topics to be discussed (Examined Internal only)

Text book	1.	Ananthanarayanan R and CK Jayaram Panicker, (2020). Textbook of Microbiology. (11Edn.) Delhi: Orient Longman.
	2.	Monica Cheesbrough, (2018). District Laboratory Practice in Tropical Countries. (2Edn.) USA: Cambridge University Press.
Reference Books	1.	Bailey and Scotts,. (1994). Diagnostic Microbiology. (9 Edn.) New Delhi: Baron and FinegoldCVMosby Publications.
	2.	Jawetz E Melnic JL and Adel berg EA,. (1998). Review of Medical Microbiology. (10 Edn.) USA: Lange Medical Publications.
	3.	Mackie and McCatney,. (1994). Medical Microbiology. (14 Edn.) New Delhi: Church will Livingston.
	4.	Patrick.K.Murray,I.N. (2012). Medical Microbiology. (4 Edn.) USA: Mosboy Publishers.

Journal and Magazines	Clinical Laboratory Science Journal Annals of Clinical & Laboratory Science
E-Resources and Website	WHO - Laboratory biosafety manual CLSI Free Microbiology Resources

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development
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Semester - III DSE III: FREE RADICALS AND ANTIOXIDANT SYSTEM							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24BCP3DA	FREE RADICALS AND ANTIOXIDANT SYSTEM	[DSE]	36	12	-	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> the concepts of free radicals, ROS & RNS, and their chemical characteristics. the importance of enzymic antioxidants in preventing oxidative damage the role of antioxidants as immunomodulators and their impacts on body.
Prerequisite	Knowledge on free radicals and antioxidants

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Demonstrate the formation of free radicals, ROS, and RNS in biological systems and their sources..	K3
CO2	Examine the effects of free radicals in various disease conditions and effect of exercise on antioxidants.	K4
CO3	Analyze the chemistry, mechanism and effect of enzymic and synthetic antioxidants	K4
CO4	Evaluate the chemistry, mechanism and functions of different nonenzymic antioxidants.	K5
CO5	Assess the role of antioxidant in therapeutics and gain insights into future perspectives and challenges in the field	K5

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

24BCP3DA	FREE RADICALS AND ANTIOXIDANT SYSTEM
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Syllabus

Unit	Content	Hrs	Resources
I	[Introduction to Free Radicals and Oxidative Stress] Definition of free radicals, Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (RNS). Formation and physiological roles of free radicals. Mechanism of oxidative damage to biomolecules (DNA, proteins, lipids). Techniques for measuring ROS/RNS levels.	10	Text Book, E-Resources
II	Reactive Oxygen Species and Disease Oxidative stress in atherosclerosis, obesity and metabolic syndrome, hypertension, Alzheimer's, Parkinson's, Mitochondrial dysfunction, skin aging processes, Air pollution and respiratory diseases. Exercise-induced ROS production, Redox balance and muscle recovery. Effects of exercise on antioxidant defense systems.	10	Text Book
III	Enzymic Antioxidants and synthetic Antioxidants Enzymic antioxidants- Chemistry, mechanism, antioxidant effect of superoxide dismutase (SOD), Catalase, Glutathione Peroxidase and the glutathione system Synthetic antioxidants: BHA (butylated hydroxyanisole), BHT (butylated hydroxytoluene), TBHQ (tert-butylhydroquinone), and their chemical properties.	8	Text Book, E-Resources
IV	Non Enzymic Antioxidants Non Enzymic antioxidants- source, chemistry, toxicity, biochemical functions, bioavailability, bioassays, Antioxidant effects of Vit A, Vit C (ascorbic acid), Vit E (tocopherols and tocotrienols), glutathione and selenium..	10	Text Book
V	Emerging Topics in Free Radicals and Antioxidant system Mitochondrial-targeted therapeutics .Antioxidants as immunomodulators. Antioxidant strategies for stem cell therapy. Redox modulators in cancer therapy Redox-active compounds in drug discovery. Clinical trials and future perspectives. Antioxidant supplementation and disease prevention. - Personalized nutrition and antioxidant requirements	10	Text Book, E-Resources
Total		48	

Text book	1.	Steven I Baskin, Harry Salem, 2020 "Oxidants, Antioxidants, and free Radicals", 1st Edition, CRC Press, Florida
	2.	Donald Armstrong, 1994, "Free Radicals in Diagnostic Medicine: A systems approach to Laboratory Technology, Clinical Correlations and

		Antioxidant Therapy; v. 366", 4th edition, Springer Science, LLC.
Reference Books	1.	Barry Halliwell and John M.C. Gutteridge, 1998, "Free Radicals in Biology and Medicine", 3rd Edition, Oxford University Press, United Kingdom
	2.	Vibila Rani, 2015, "Free Radicals in Human health and Disease", 5th edition, Springer, New York, USA.
	3.	Helmut Sies, 1991, "Oxidative Stress: Oxidants and Antioxidants", 2nd edition, Academic Press, London, United Kingdom
	4.	Dietmar Spengler, 2015, "The Redox Theory of Aging: Physiological Roles and Mechanisms of Aging", 3rd edition, Springer, New York, USA.

Journal and Magazines	<u>Free Radicals and Antioxidants Open Access Pub; Free Radical Research Taylor & Francis Online</u>
E-Resources and Website	<u>https://youtu.be/rm5IfvG5C6c?si=KxQU7BYHKfbrphD1</u> <u>https://youtu.be/cXvDLLGBR4s?si=XijfydUfOaHYTWjO</u> <u>https://youtu.be/dPNuogiy6zE?si=ku2z3lKnXLP2yfsQ</u>

Learning Method	Chalk and Talk/Assignment/Seminar/Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability
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Semester - III DSE : MOLECULAR THERAPEUTICS							
Semester	Course Code	Course Name	Category	L	T	P	Credits
III	24BTP3DA	MOLECULAR THERAPEUTICS	DSE	36	12	-	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> • The types of gene therapy and drug delivery. • The importance of cell therapy and recombinant therapy. • The basis of microbial pathogenesis and various immunological approaches.
Prerequisite	Knowledge on various therapies

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Sketch the process of drug targeting and gene therapy.	K3
CO2	Evaluate the use of stem cells and tissue engineering in therapy.	K4
CO3	Summarize recombinant gene therapy	K5
CO4	Integrate pathogenic diseases and metabolic disorders.	K5
CO5	Design the concept of immunotherapy and its applications.	K5

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓		✓	✓
CO5	✓	✓			✓

24BTP3DA	DSE: MOLECULAR THERAPEUTICS
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Syllabus

Unit	Content	Hrs	Resources
I	Concepts of Gene Therapy and Drug Delivery Introduction to Gene Therapy, Drug targeting and drug delivery system. Intracellular barriers of gene delivery, gene therapy for inherited and acquired diseases, virus mediated gene transfer. Liposome and Nanoparticles mediated gene delivery.	09	Text Book
II	Stem cells and Tissue Engineering Introduction to Cellular therapy. Stem cells: definition, properties and potency of stem cells; Sources: embryonic and adult stem cells, Role of adult and embryonic stem cells in therapy. Concept of tissue engineering; Role of scaffolds; Role of growth factors in tissue engineering. Clinical applications and Ethical issues.	10	Text Book
III	Recombinant Gene therapy Introduction to Recombinant therapy, Clinical application of recombinant technology, Erythropoietin, insulin analogs and its role in diabetes, Recombinant human growth hormone, streptokinase and urokinase in thrombosis. Recombinant coagulation factors	10	Text Book
IV	Microbial Pathogenicity General concept of infectious disease, types of infectious diseases. Progression of Infection and Disease -Entrance (Portal of entry), Colonization (Adherence; Adhesion; Attachment), Prevention of Host Defenses, Antigenic Variation, Penetration into Host Cytoskeleton, Damage to Host Cells, Production of Toxins.	10	Text Book
V	Immunotherapy Introduction to Immunotherapy, Monoclonal antibodies and their role in cancer treatment, role of recombinant interferons, Immunostimulant and Immunosuppressors in organ transplants, role of cytokine therapy in cancer. MAMP, RAMP and DAMP triggered immunity. Vaccines: types, recombinant vaccines and their clinical applications.	09	Text Book
Total		48	

Text book	1.	Palsson, B. and Bhatia, S. N, 2004, "Tissue Engineering", 2 nd Edition, Prentice Hall, USA.
	2.	Greenwell, P. and McCulley, M, 2008, "Molecular Therapeutics: 21 st century Medicine", 1 st Edition, Wiley-Blackwell, USA.
Reference Books	1.	Coleman, W.B. and Tsongalis, G.J, 2006, "Molecular Diagnostics for the Clinical Laboratory", 2 nd Edition, Humana Press, USA.

2.	Leonard, DGB, 2016, "Molecular Pathology in Clinical Practice", 2 nd Edition, Springer International Publishers, USA.
3.	Whitehouse, D. and Rapley, R, 2012, "Molecular and Cellular Therapeutics", 1 st Edition, Wiley – Blackwell Publications, USA.
4.	Quesenberry, P.J. and Stein, G.S, 1998, "Stem Cell Biology and Gene Therapy", 1 st Edition, John Wiley and Sons Publications, USA.

Journal and Magazines	https://www.cell.com/molecular-therapy-family/molecular-therapy/home https://www.nature.com/gt/ https://www.cell.com/stem-cell-reports/home https://home.liebertpub.com/publications/tissue-engineering-parts-a-b-and-c/595/overview https://www.tandfonline.com/journals/irme20 https://www.sciencedirect.com/journal/microbial-pathogenesis https://journals.lww.com/immunotherapy-journal/pages/default.aspx https://www.eurostemcell.org/ https://asm.org/a/microcosm-digital-magazine https://www.immunology.org/publications/immunology-news
E-Resources and Website	https://www.asgct.org/ https://www.sciencenews.org/ https://stemcellsportal.com/ https://termis.org/ https://www.newscientist.com/ https://www.scientificamerican.com/ https://www.ema.europa.eu/en/homepage https://www.biopharminternational.com/ https://www.cancer.gov/about-cancer/treatment/types/immunotherapy

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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Semester - III							
SELF STUDY: GOOD MANUFACTURING PRACTICES							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MBPSSA	GOOD MANUFACTURING PRACTICES	Self-Study		-	-	1

Syllabus

Unit	Content	Hrs	Resources
I	Principles and Importance of GMP Principles and Importance of GMP – Definition of GMP, Quality management, Personnel, Risk management, Quality control, Documentation, Inspections.		Text Book
II	Chemical Labelling & Safety Chemical Labelling & Safety - Safe handling of chemicals and equipment in the laboratory. Handling and disposal of infected, dangerous materials, accidents, safety measures, fire safety, emergency treatment.		Text Book
III	Sanitation Sanitation - Cleaning and sanitation compounds and their uses – for process equipment's - for environmental cleaning (drains, coolers, etc.) - influence of water quality. Environment sanitation and monitoring - environmental monitoring / pathogen testing - pest control programs.		Text Book
IV	Equipments and SOPs Emergency Equipment & Standard Operating Procedures – Maintenance of emergency equipment in a laboratory setting - evaluating Standard Operating Procedures (SOPs) and safety plans.		Text Book
V	Regulatory Agencies International and federal regulatory agencies that impact the work of Microbiology - WHO, FDA, CDC, EPA, FSSAI.		Text Book
Total			

Text book	1.	Mark Gregory Slomiany, 2009, "The indispensable guide to Good laboratory practices", Second edition, Create Space Independent Publishing Platform, Scott Valley
Reference Books	1.	A WHO guide to good manufacturing practice (GMP) requirements: Volume 1,2,3,4,5. Part 2-Validation, by Gillian Chaloner-Larsson, Ph.D, GCL Bioconsult, Ottawa.
	2.	Good Manufacturing Practices for Pharmaceuticals, Sixth Edition by: Graham Bunn Publisher.
	3.	Sandy Weinberg, 2007, "Good Laboratory Practice Regulations", Fourth Edition. CRC Press, US.

Journal and Magazines	http://ebookey.org/GoodManufacturing-Practices
E-Resources and Website	Health products policy and standards

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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Semester – III							
SELF STUDY: INTRODCUTION TO HUMAN ANATOMY							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MBPSSB	INTRODUCTION TO HUMAN ANATOMY	Self-Study		-	-	1

Syllabus

Unit	Content	Hrs	Resources
I	Parts of the body Parts of the body-body cavity, trunk, upper limb, lower limb- membranes-mucos, serus, synovial-basic tissues-epithelial, connective tissue, neuron.		Text Book
II	Skeletal and Muscular system Skeletal system: Classification and functions of skeletal system – structure of bone- joints-clinical aspects. Muscular system: classification and functions-chief muscles of the body.		Text Book
III	Respiratory and cardiovascular system Respiratory system: Organs of respiration – Nose, Nasopharynx, larynx, trachea, bronchi, lungs – clinical aspects. Cardiovascular system: Heart, circulation of blood, pulse, blood pressure-lymph node, thymus.		Text Book
IV	Digestive and Urinary system Digestive system: Organs of digestive-mouth, tongue, esophagus, stomach- intestine-small intestine, large intestine. Urinary system: components of urinary system-kidney, nephron, ureters, urinary bladder – functions of kidney.		Text Book
V	Reproductive and Nervus system Reproductive system: Female reproductive system-internal genital organ-external genital organ-male reproductive system – internal and external genital organs. Nervus system: nervus system-neuron, cerebral cortex, cerebellum, cerebrospinal fluid, spinal card.		Text Book
	Total		

Text book	1.	Krishna Garg and Medha Joshi. 2017. "Anatomy and Physiology for Nurses", First Edition, CBS Publishers Pvt Ltd.
	2.	Anne Waugh and Allison Grant. 2006. "Anatomy and Physiology in Health and Illness", Tenth Edition, Churchill Livingstone, Elsevier.
Reference Books	1.	Gary A. Thibodeau, Kevin T. Patton. 2013. Structure & Function of the Body", 14th Edition, Elsevier
	2.	Ranganathan TS. 2000. A Textbook of Human Anatomy, 1st edition. S Chand Publishing

Journal and Magazines	hnptel.ac.in/courses/102104058
E-Resources and Website	Human Heart- Location, Anatomy, Structure, Functions

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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